INFORMATION TECHNOLOGY and Management

Ashwin Fernandes

A Mittal Publication

The rapidly accelerating advent of information technology is highly powerful, novel, widespread, and influential.

The new technology revolution have shrunk the planet to a tiny global village. The modern society is leading to overall improvements in work, commerce, health, and entertainment, through the fruitful facilities made by information technology.

This book offers the most thorough treatment available on information technology and its management problems. This unique work will be highly useful to information scientists, managers, programmers and students.

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Preface

The rapidly accelerating advent of information technology is highly powerful, novel, widespread, and influential. The new technology revolution have shrunk the planet to a tiny global village. Nowadays, electronic communications and news media have become commonplace and indispensable; computers have proliferated, becoming increasingly fast, powerful, small, and cheap, so that now there is scarcely a human activity in which they are not to be found, bearing an increasing share of the burden of repetitive information processing. The modern society is leading to overall improvements in work, commerce, health, and entertainment, through the fruitful facilities made by information technology.

Nowadays, it is relatively easy for a manager to surround himself with computer-generated information. Sometimes the manager becomes fascinated by the new tool and excessively interested in manipulating information at the expense of other aspects of his job. More often the result is that the information goes unused and the management process is largely unchanged. The most common management view of information technologies is perhaps that they offer vehicles where by their staff can produce information more quickly and more accurately—but in practice the technologies cause restrictions and problems. Information technology has certainly progressed at a revolutionary pace, constrained partly by the inability of the software specialists to keep pace and control costs, but constrained mainly by the adaptiveness of the people who run the business. Most innovations of a scientific nature have taken many years to achieve their full potential. We are probably only half way through the computer revolution and the second half will certainly be driven by the skill and imagination of those who can profit from the technology rather than by the technical advances of the engineers.

The technologies will continue to change and the rate of change may even quicken but the ability of managers to live with that change and make it work for them will be the critical success factor. The success of an information strategy will be measured in terms of the ability of the organisation to capitalise on the opportunities, either by operating more efficiently and more effectively, or by deriving some competitive or business advantage from the technologies.

This book offers the most thorough treatment available on information technology and its management problems. This unique work will be highly useful to managers, information scientists, programmers, and students.

Editor

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Information Service Management

An information service aimed at a fairly wide area may need to limit its interests to a particular sector of the community or to a particular range of subjects, e.g. the low paid, those receiving income support, or those with debt problems. Even an information service in support of a local campaign may benefit from collecting information on similar campaigns or problems country-wide. The information base of an information service is most likely to include the following types of information:

1) *Soft information*: Usually this information will not be available in a published form, or at least not in sufficient detail, and it will be necessary to make a conscious effort to collect it. This information may comprise the major part of the resources file.

2) *Hard information:* This information will be available in a variety of Banns, some ephemeral such as leaflets, pamphlets, booklets, broadsheets, posters, periodical articles, etc. Such items are usually kept in a vertical file, in storage boxes or similar receptacles and accessed via some form of index or classification scheme. Other hard information may be in the form of books, multi-volumed reference works, law books, or even audiovisual forms. If there are many items of this type, they will need to be classified and shelved.

3) *Supplementary information*: These informations are already produced in a particular format—directories, handbooks, diaries, annual reports, constitutions, newsletters—of organizations appearing in your information file.

Soft information

An information service should need to 'go it alone' in the collection of information. Complexity and variety of sources of information in present-day society that, unless your service has very narrow terms of reference, it will be virtually impossible for it to collect and keep up to date all the information that is required. Therefore, it is important that you first of all identify the information providers, support services and 'gatekeepers' in your community and establish effective contacts with them. These links may already have been forged in the process of conducting a community profile. They now need to be fostered and strengthened, so that there can be a mutual exchange of information. These contacts will also be able to provide you with useful feedback from the community as to the success or otherwise of your service.

The network of contacts can be maintained on a fairly casual basis as the need arises, or you might want to formalize the arrangement. Some ways of doing this include irregular 'get togethers', informal luncheon clubs, regular meetings with agendas and minutes, or the circulation of a newsletter or bulletin. Other activities that could develop out of such meetings are joint collection of nformation, shared publicity, compilation and publication of directories, information handbooks and leaflets, training, and general discussion of common problems.

Collecting information is a time-consuming process and there is no one method of going about it. You will probably have to use a combination of several techniques to build up a satisfactory information base. One thing definitely to be avoided is duplicating work that has already been done. So first of all identify the following:

1) *Existing information files:* Contact all the other community information services, council departments and organizations who are likely to maintain information files and ask if they would be willing to share this information. Try to offer something in return, either an exchange of information or some other help you can provide.
2) *Local directories:* There are several types of directory that may be available in your area and which are useful sources of soft information:
    a) Local government authorities often produce directories or town guides of their area which contain a certain amount of local information or they may produce a guide to council services;
    b) Telephone directories, especially *Yellow pages* which have an alphabetical subject arrangement;
    c) Area directories, such as those produced by Thompson's Newspapers, which are similar to *Yellow pages* but also contain a section of community information—your local newspaper may produce a directory of local services, sometimes in conjunction with local information groups;
    d) Citizen's guides may also be produced by the local newspaper as a supplement to an existing newspaper;
    e) CVSs or RCCs sometimes produce directories of voluntary organizations in their area or you may find these listed in your local CVS/RCC annual report;

f) Directories covering a special subject, such as accommodation, halls for hire, etc.;

g) Directories aimed at a particular interest group or groups e.g. people with disabilities or senior citizens.

3) *National directories* are useful not only for the wider network of services but also for identifying local offices of a national organization.

Other methods to use in building up your information base and maintaining its currency include:

— *Looking and listening:* A lot of information can be gathered by simply walking around your community, looking at noticeboards, picking up leaflets, or attending open meetings, fairs, fetes and other community events.

— *Contact with individuals:* People are a major source of information in any community and there are always those to whom others naturally go for information. Try to identify such people and enlist their help, possibly by offering something in return—bartering is a time-honoured system! Direct contact with individuals in other information services and organizations is often a better way of eliciting information than impersonal methods and also paves the way for further cooperation.

— *Scanning newspapers, magazines, newsletters, etc.,* can turn up details of new organizations; changes of personnel, premises or hours of opening; new services introduced; and may highlight problem areas where information may be needed.

— *Other documents,* including council minutes and agendas, planning regulations, annual reports, leaflets and manifestos.

- *Media publicity:* Local press, radio and cable television stations may be prepared without charge to put out a call for organizations to contact your service. If not, then consider inserting an advert or, where there is, a local directory produced, have a tear-out slip included for organizations to fill in and return to you. As a result of these various methods, an amount of raw material will have been obtained which may be of use to your information service.

The information you have obtained will be of several different kinds but the most common will probably be that relating to organizations, clubs and societies. This is the most difficult type of information to collect since it is ever changing and therefore unrelenting effort will be required to achieve even reasonable completeness or accuracy—100% will be impossible.

However, with a good system for collecting and updating the information, you should be able to build up and maintain an acceptable file. A lot of staff time will be needed to carry out this work, so first of all investigate whether there are other local information services that need this type of information and would be willing to help in its collection. It may be possible to collect the information through an umbrella group, where the work can be farmed out so that it is not too great a burden on any one organization. Alternatively, a joint approach can be made on behalf of a number of organizations.

The most effective way to collect information of this kind is to pay a personal visit to each organization or service, but rarely will that be possible without extensive staff resources or a very small community. The cheapest and quickest way to collect this information is by telephoning. Prepare a standard list of questions to ask so that entries in your information file follow the same format.

Telephoning is only practicable if you have a reasonably small number of organizations to contact, say up to one hundred. If visits and telephoning are ruled out, then the information can be collected initially by postal questionnaire, with a request for up-to-date information sent at least once a year and also when it is known from other sources that changes have taken place. A covering letter should be sent with the questionnaire or update request, explaining why the information is needed and asking for cooperation.

If the information is to be passed on to other organizations or commercial bodies, either free or for payment, this should be drawn to the attention of the recipient of the questionnaire, so that they have an opportunity to decline to give the information or insist that it is not so disseminated. If the information is to be stored in a computer, then you will need to meet the requirements of the Data Protection Act. If it can be afforded, include with your questionnaire some means of returning it free of charge, as this will significantly improve the response rate. Separate forms may be required to collect different kinds of information.

A community information service might need to know about an organization or service. Depending on the scope of your service, it may not be necessary to include all the fields in the questionnaire. It is a good idea to get the person filling in the questionnaire to sign it, thereby giving the information service some protection against claims of giving out wrong information—a not uncommon occurrence, especially when the information is committed to print.

There are other types of 'soft' information that your service might need to collect, for example halls for hire, places of local worship, accommodation, 'What's-on' events, local industry.

There are various methods that can be used for storing information:

— *List*: A list is easy and quick to consult, can be photocopied for clients to take away and can be faxed, but has very little flexibility for inserting and updating information.

— *Strip index:* A strip index provides flexibility, can easily be photocopied, and is available in various forms: large binders holding many pages, smaller folders containing just a few pages, address books, wall-hung panels, rotunda units, etc. Strips are available in several colours, which allows for a simple categorization, and various widths.

— *Cards:* Cards are still one of the most commonly used systems for storing information. They are infinitely flexible, easy to insert and update, can be sorted into any preferred order, and require very little technical know-how. The most popular sizes are 5in × 3in, used mainly for indexes or temporary information waiting to be checked, 6in × 4in, and 8in × 5in, which are large enough to contain sufficient information about most organizations or services and to be preprinted with a standard grid for recording the information. There are more superior types of card file available, such as the Rondofile or Rotadex systems which use custom-designed stationery and therefore tend to be more expensive. With systems that use standard cards, you can—if you are hard-up or want to save trees—use the reverse of scrap cards. Card files have a number of disadvantages: they are not so easy to carry around, they are not easily reproducible if someone Wants a copy of a particular section, multiple access requires duplication of cards, and the updating process can be tedious. You may still find around edge-punched cards which offer a primitive type of multi-access to the information on the card through the strategic use of knitting needles or rods.

— *Loose-leaf binders:* Loose-leaf binders with one sheet for each entry, sometimes called 'sheaf' binders, have a similar flexibility to cards. They are slightly slower to add to and amend but are more portable. They are suited best for alphabetical arrangements as they are difficult to guide.

— *Microcomputers:* Microcomputers now have the capacity to handle immense information files that can be accessed by any number of predetermined variables or even free-text searching by keyword, depending on the software used. With a printer attached, all the information or sections of it can be printed out on demand or to provide a master for printing by conventional methods. Personal computers now begin at prices that bring them within the range of most community information services. However, there is danger in automatically seeing the computer as the best solution for maintaining your information file, as this may not always be the case. A lot depends on the size of your file and its complexity, what you want to do with the file, and to what other uses you want to put the computer.

Filing systems

The total resources of your information service are used to the full when answering an enquiry, it will help if the system used to organize the information file can be integrated with that for the vertical file and the bookstock. This point needs to be borne in mind now, although it will be dealt with more fully later. The bulk of the information file is likely to comprise 'soft' information which you have collected about organizations, clubs, societies and services and, to a lesser extent, about individuals who are a valuable source of information or advice, plus items of 'hard' information not available or conveniently available in printed form. There are several ways in which you might want to retrieve this information—by the names of the organizations, by subject, by clientele, by the type of service, or by place. In practice, the 'clientele' and 'type of service' approaches are usually catered for through the subject file rather than as separate files.

— *Organizations file*: The master file for the whole system will usually be an alphabetically arranged sequence of entries by name of organization. It is generally recommended that the full, official name of the organization is used, with references from other forms of the name. In practice, it does not really matter as long as there are references from the alternatives to whichever form is chosen. There is a good argument for putting the main entry for an organization under the form of name by which most people refer to it, even if this differs from or is an abbreviation of the official name. This is especially so where the file is to be used by the public. In addition to details of organizations, each entry in the master file may also contain certain 'housekeeping' details relating to the maintenance of all the information files, plus references to appropriate headings in the subject file, where relevant information can be found, and a classification number.

— *Subject file*: Most enquiries received by a community information service are likely to be about the need for a service or activity or for help with solving a problem, rather than for information on a specific named organization. So the information you have collected about organizations, services and individuals will also need to be accessible by the services and activities they provide. There are two ways this can be achieved, by either using a subject index or having a subject file of organizations. In both, you will need to choose or adopt a set of subject headings which will adequately describe the information on file or elsewhere in the system and the interests of your clientele.

A *subject index is* rather like the index to a book. It is an alphabetically arranged file of subject heading cards on which reference is made to where information on that subject can be found. The cards themselves do not contain information. The subject index can contain references to organizations, individuals and other supplementary material such as pamphlets, periodical articles, audiovisual material, books, etc.

A *subject file* consists of an alphabetically arranged set of subject heading cards behind which are filed copies of the organization cards appropriate to that heading and possibly cards containing items of 'hard' information. An alternative is to arrange cards according to a classification system either devised by yourself or adopted from another service, such as the NACAB classification scheme.

Place file: Where an information service covers a number of distinct towns, villages or neighbourhoods, each having a similar range of organizations, it may be helpful to have a file that can be accessed by place. There are a number of options. You could sort the organizations file initially by place, especially if it contains few organizations whose responsibilities extend to the whole area covered by your service. Alternatively, if most of the organizations are prefixed with the name of the place, the alphabetically arranged master file will automatically bring together those from the same location, provided inverted headings have not been used. Some arrangements will have to be made for organizations which do not conform to the pattern, either because the place-name does not feature at the beginning or because it is not contained in the name of the organization at all.

Filing alphabetically is not quite as simple as ABC, as any librarian will tell you. There are two recognized methods, known as 'word by word' and 'letter by letter'. In word by word, entries are initially sorted by the first word in the heading, then headings that begin with the same word are sorted by the second word and so on. Another way to describe this method, which may be more helpful, is to treat spaces between words in a heading as an imaginary letter coming before 'a' in the alphabet, then sort letter by letter. In letter by letter, you simply ignore any spaces in the heading and sort one letter at a time from left to right. Here is how a small group of headings would look sorted by the two methods:

Word by word	*Letter by letter*
DO SOMETHING! BOYS CLUB	'DOG AND BONE' DARTS TEAM
'DOG AND BONE' DARTS TEAM	DOGSBURY RESIDENTS' ASSOCIATION
DOG SNIFFERS ANONYMOUS	DOGS HOMES
DOGS HOMES	DOG SNIFFERS ANONYMOUS
DOGSBURY RESIDENTS' ASSOCIATION	DO SOMETHING! BOYS CLUB

There are several other niceties to do with filing alphabetically but we only need mention here that hyphens are treated as spaces in word-by-word sorting and numerals are spelt out as said, so that 1900 (the year) is considered for sorting as NINETEEN HUNDRED and 1,900 as ONE THOUSAND, NINE HUNDRED.

In addition to the information needed to answer enquiries, there are other items of information to do with the maintenance of the file which may usefully be included on each entry, such as the following:

- the date the information was obtained, last updated or last checked, which will indicate not only the degree of reliability to be placed on it but also when to update;
- the date a questionnaire or update letter was sent—a check for chasing up non-returned forms;
- additional contacts or other information which does not fit into the main part of the entry;
- subject headings used in the subject file;
- place headings used in the place file, if not obvious from the name of the organization;
- feedback—comments from users of the service;
- 'tracings', i.e. a list of other cards that refer to they can be traced and amended or withdrawn when necessary.

Amount of this 'housekeeping' information you need to include will depend on how sophisticated you need your file to be. The bigger the information service and the larger the file, then the more likely it is that you will need to introduce a systematic procedure for processing information. In such a case it is usual for the housekeeping information to go on the reverse of each entry, using a standard grid like the one illustrated here.

If your information file requires this degree of sophistication, you ought seriously to consider keeping it on computer. For a small community information service, it may be quite adequate just to note the date when the information was collected, checked or updated. By their very nature the entries in your database will be changing continually. Hours of opening, meeting places, officers, membership fees, subscriptions, charges, etc., are all susceptible to frequent change. Therefore, it is important to have a system for regularly updating each entry in the database. There are several ways of achieving this but, whichever method you adopt, it must be regular and ongoing.

All the entries for organizations should be checked at least once a year to ensure they are still correct. In between times, however, new information will be brought to your attention by various means, including word of mouth, newspaper reports, organization newsletters, company reports and by direct contact with the organization itself. If the source of information is reliable, it can be substituted immediately for the out-of-date information in the database but, if not, it should be noted and a further check made to verify its accuracy. A simple way to add new information to an entry in a card file is to write it onto self-adhesive labels or slips which can be stuck over the original information. Even though an entry has been updated in between times, it should still be checked formally once a year.

Once a year is probably a reasonable time-span for updating your database but a shorter interval may be necessary if the information content changes frequently. You will need to decide how the annual update is to be carried out. Some organizations like to update the entire file at the same time, so that they can say the file was as accurate as possible at a particular date. However, this does create a tremendous amount of extra work for a period of several weeks and you may feel it necessary to get extra paid, work-experience or volunteer help. Another disadvantage of this method is that it captures a picture of organizations at a set moment in time.

Some organizations may be just about to make changes, and your records for these would be out of date for almost a year. Alternatively, you may decide to update on a continuous basis by using either the date the record was added to the database or the organization's annual general meeting (AGM) date as a trigger. This is easy to do if your database is kept on a computer, since a date field can be used to produce a subset of records and, by linking the database with a word processing package, a personalized standard letter can be printed out for sending to each organization. It is less easy with a card or any other kind of file. You can get little coloured metal tags to clip on to the top edge of cards, a different colour for each month, or you could use an appropriate symbol on the heading of the card, such as a coloured dot, a letter or number. Tags can make the file look a bit messy and are easily knocked off if it is in constant use; symbols require the whole file to be checked through.

As many organizations do not know their AGM date a year in advance, it is enough just to indicate the month in which the AGM is usually held. For those organizations and services which do not have an AGM, you will need to use the date the information was added as the trigger. When writing to organizations to update their information, it is better to send them a copy of their record with a request to indicate any changes, rather than sending a blank questionnaire. This saves the secretary unnecessary time in repeating information that has not altered. An alternative to writing to each organization is to phone, but this is time-consuming and costly, and only feasible if the number of organizations to contact is fairly small. Avoid sending out updates at times when people are likely to be away, such as during the summer. There are certain times when it is more appropriate to update other kinds of information, e.g. social security benefit rates, adult education classes or school, college and university courses which change termly. When an updated entry is returned it should be checked to see if the subject or place headings still apply. Minor changes can be recorded on the master card and any other cards in subject or place files; major changes may require a new set of cards to be produced. For those with computerized databases the process is simpler as just the one record has to be updated.

Hard information

Most information services will need a certain amount of 'hard' information to answer enquiries. Short, unrecorded or inadequately recorded items of 'hard' information, as we have already seen, can be incorporated into the database. However, the majority of hard information will usually be found in one or more of the vast range of print forms, starting from locally produced free broadsheets to extremely expensive multi-volumed loose-leaf reference works.

The procedure for obtaining priced publications, particularly in the field of community information, is not as simple as you might suppose. Since a lot of the material may well be fairly cheap and from small or community publishers, booksellers and library suppliers are reluctant to obtain it as the profit margin is likely to be too low for the amount of effort involved. The alternative is to order direct but this also has its difficulties as many small publishers now insist on money with order, and this can cause problems for some organizations through the need to raise a cheque or limitations on the amount that can be spent from petty cash.

A few national voluntary organizations, e.g. Age Concern England, operate a standing-order system for their publications—this is one solution, although you may need to accept blanket coverage of the organization's output. In the larger cities, you may find a community or alternative bookseller who is prepared to supply this material to order. A directory of alternative bookshops is published annually by the magazine *Radical bookseller*. Whatever the method of ordering, it is important to keep a record of what has been placed on order and from whom to avoid duplication of titles and as a check on supply. For each title make out an order or slip—this can be either a scrap 5in × 3in card or one specially printed with a standard grid.

The following indicates the kinds of information that need to be recorded:

- title of publication—more important than author for this kind of material, since authorship is often unclear;
- author—might be an individual or an organization;
- price, date of publication and, if a periodical, frequency;
- supplier—this may be a bookseller, library supplier or the address of the producing body;
- date of order;
- source of information about the item;
- location, if you are ordering for more than one centre.

You may find it helpful to use the order cards later as the basis of a catalogue of the publications in your information centre; in which case, leave space at the top of the card for either a subject heading, classification number or filing code. After an order has been placed with a supplier, the order cards are filed, preferably by title, in one alphabetical sequence known as the 'order file'. When a publication is received, the order card is removed from the file and accompanies the publication to the next stage if it is to be used later as the catalogue card. If not, you may find it useful to file the order card in a 'publications received' file, until such time as the publication is permanently recorded in the system, after which the card can be thrown away.

Publications which arrive at regular intervals—weekly, fortnightly, monthly, quarterly—will not require an order card but you will need to keep a record of each title taken. This should include the following items of information:

- title of periodical;
- frequency;
- supplier;
- when subscription is due for payment;
- a grid to record receipt of each issue;
- instructions for disposal of back copies.

For those using computers, there are software packages available for periodicals management but these are aimed at organizations who take an extensive range of periodicals and such packages are not cheap. If you have a database management package on your computer, you would do better to devise your own periodicals database.

Free material can vary from quite substantial loose-leaf binders plus updates to leaflets, posters and bookmarks and may be required in bulk for clients to take. Since this is likely to be a frequent type of request, it may be quicker and simpler to duplicate a standard letter to send to organizations, with space left to fill in address, title of item, format and number of copies required. It is advisable to keep a record of what is requested, if only as a check on whether it has been received or not. A lot of the sweat has been taken out of identifying free materials, and addresses from where they can be obtained, through the setting-up of Camden Libraries' Free Leaflets Information Service (FLIS). For an annual fee (£120 in 1992) subscribers receive a copy of the Frills directory of free information leaflet suppliers, a monthly batch of new and updated leaflets and amendments to the *Frills* directory, and details of a model system for organizing leaflets. Details of this service can be obtained from Community Information Services, Camden Leisure Services Department, St. Pancras Library, 100 Euston Road, London NW1 2AJ. A similar, but not so extensive, service is provided by the NACAB as part of its Information Service, but you would need to have approval to subscribe to the full pack.

Hard information can be found in a great variety of forms. For the benefit of organizing it, the following categories can be identified:

- *Material in book form* for use by clientele or information workers will be best arranged on shelves in the broad subject groups identified when acquiring the material or according to a classification scheme.
- *Ephemeral material for use by information workers* is best stored in a vertical file using the same subject headings as those in the subject sequence of the information file, though probably with more subdivisions, or using a classification scheme. Alternatively, the material could be kept in file boxes on shelves using broad subject headings.
- *Ephemeral material for use by clientele on the premises* is best kept in file boxes, ring or display binders and ideally interfiled with books. Vertical files are not recommended for public use as they tend to be a deterrent. Another way of dealing with ephemeral materials is to gather them together in packs on particular topics and, for maximum impact, to display them face outwards on sloping shelves.
- *Ephemeral material for the public to take away* can be displayed in special leaflet dispensers, on a sloping surface or on tables. Ideally, they should be displayed in broad subject groups or by originating

organization, but this is rarely possible because even within organizations leaflets are produced in varying sizes.

Supplementary information

Many organizations produce printed material in the course of their work or activities. The most common types of material are directories or address lists of members, newsletters, events sheets or cards, annual reports, constitutions, posters, leaflets, funding appeals, campaigning literature, advertising brochures, balance sheets and commemorative booklets. All this material is potentially useful as back-up information to the database but there is no sure way of obtaining it. When sending out the original questionnaire to organizations, you can ask to be put on their mailing list for this type of material, if one is maintained.

Some organizations that operate on a shoestring may make a small charge for their mailing list facility. Even when you are put on a mailing list, regular receipt of material may depend very much on the enthusiasm or efficiency of the secretary of an organization. Often the best solution to obtaining material is to maintain regular contact with organizations and to pester them continually. When material arrives, it should be dated, so that you know roughly how old it is, and carefully filed for future use. The simplest method is to have an envelope or folder for each organization.

Write on the outside of the envelope the name of the organization as used in your database and arrange envelopes alphabetically in boxes or a vertical file. You should also add to this file any cuttings from newspapers or magazines concerning those organizations. The file should be checked regularly, at least once a year, to remove out-of-date material.

The community information service input is directed towards selecting appropriate materials, reprocessing information in a form that can be readily understood, packaging information, and arranging all these materials in a way that is easier for the customer to use. This kind of service is most suitable where there is insufficient staff or lack of trained staff to operate a personal enquiry service, such as a small branch or mobile library, or for deposit in an unmanned centre. It is usual for materials to be assembled, produced or packaged by a district or central office. Where there are adequate information services for the public, the greater need may be for an information service to support the work of other agencies and workers in the field.

The process of information-advice-advocacy is often referred to as a 'continuum'. Boundaries are blurred and not generally recognized by users, even though, in setting up a service, limits have to be placed on its actions. Someone seeking information or help with a problem is not really interested in the philosophy of your organisation but in obtaining a satisfactory answer, or solution, irrespective of the means used to obtain it. Consequently, some people have argued that it is wrong to set up an information service and attempt to limit its functions to just giving information or advice but not advocacy, since users' expectations may be raised but not completely satisfied. On the other hand, it can be argued that something is better than nothing.

The structure of an information service whose community covers a large geographical area—nation-wide for instance—may need to reflect a greater usage by telephone or post, rather than face-to-face contact with clientele. A general rule, already mentioned but worth repeating, is to start modestly and then expand from a secure base, rather than to overcommit at the start and then have to retract.

Information service management

Information service is set up to meet the needs of a given community and one of the best ways to ensure that the service meets its objectives is for the community to be represented on its management. A fairly common pattern is for a management committee to be made up of representatives from statutory bodies, the service itself, and from individuals and groups in the community. No one group should dominate the management committee and its chairperson should preferably be neutral.

An independent committee is particularly necessary where an information service works in the voluntary sector but receives most of its finding from a statutory body. This is in order to guarantee that undue pressure may not be exerted by the funding bodies on the way the service operates.

It may be more difficult for a community information service belonging to a statutory organisation to have an independent management committee and, in those circumstances, an alternative would be to set up some form of advisory group representing users. The responsibilities of a management committee or advisory group might include some or all of the following:

1) laying down rules for the use of the service;
2) monitoring use and recommending changes;
3) suggesting new strategies or areas of work;
4) ironing-out trouble spots;
5) taking community action where lack of provision or malpractice is identified by the information service;
6) lobbying for funds or improved facilities;
7) giving specialist advice and help on such matters as budgeting, publicity, law, etc.

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Establishing and operating a community information · service requires certain resources:

1) *finance:* capital and revenue;
2) *facilities:* premises and equipment;
3) *staff:* paid/voluntary, training, health and safety, etc.
4) *a system:* for the collection, processing, storage, retrieval and dissemination of information.

Finance

Whether you are setting up a community information service from scratch or simply adding another function to an existing service, there are bound to be financial implications. Capital expenditure will most probably be required to provide premises, furniture and equipment. Revenue will be required to pay for such considerations as:

— staff salaries and travelling expenses;

— rent and rates;

— heating, lighting, water and telephones;

— insurances;

— stationery;

— publicity and promotion.

A budget or business plan is drawn up, setting out as accurately as possible the costs involved, so that expenses and sources of finance can be identified. A non-statutory organisation setting up an information service for the first time has a number of possible sources of funding:

Local authority funding is usually given in the form of a grant which usually has to be Applied for and agreed each year. Counties, district councils, parish councils are all empowered to make grants for this purpose. They will be the most likely source of substantial continuous finding and the most problematical. Often the decision is made close to the end of the financial year and so an information service may find itself always existing on a financial knife-edge. Changes in the political control of a council can often spark off a reappraisal of support for services. Moreover, there is sometimes covert pressure by local authorities to influence the policies of organisations they fund, particularly those policies of which the authority disapproves.

Local authorities can also give grants for capital expenditure—premises, furniture and equipment. Some will use their lotteries fund for this kind of grant, but not for revenue funding. In recent years, the introduction of rate-capping and standard spending assessments (SSAs) has severely curtailed the amount of money that local authorities are able to commit to the support of non-statutory services. At the same time, other government legislation on, for example, compulsory competitive tendering is aimed at forcing local authorities to divest themselves of services that can, in the government's view, be better provided by the private or voluntary sectors. This may include local authority-run information and advice services. Where services are operated or taken over by voluntary organisations, there is a growing practice amongst local authorities to set down what is expected of the voluntary organisation in a contract which is signed by both parties and monitored. If you cannot get funding from the local authority, it may be prepared to give support in kind, such as the provision of premises or shared accommodation in one of its own buildings, e.g. the library, or community centre.

The most likely local authority departments to approach are social services, leisure and amenities, libraries or education. Look out too for officers with titles like 'Community Development Officer', 'Youth and Community Officer', or 'Community Services Librarian', who may be able to advise you on what kinds of financial or other help are available. Your local Council for Voluntary Service (CVS) or Rural Community Council (RCC) may be able to advise you on the right approach to local authorities.

The voluntary sector's prospects of funding from central government are not rosy at this present time, particularly for new projects. Funds available are contracting and many of the government departments are now channelling their grants through other agencies, such as Training and Enterprise Councils. It would be advisable to consult your local Council for Voluntary Service or any of the books listed at the end of this section for the latest position regarding grants. The following sources currently available may be of particular interest for a voluntary organisation wishing to set up an information or advice service.

— *Public Library Development Incentive Scheme (PLDIS)* funded by the Department of National Heritage and administered by the British Library Research & Development Department is also available to voluntary organisations.

— *Training and Enterprise Councils (TECs)* are an important local source of funding, much of it coming from the Department for Employment. They will be particularly interested in projects that stimulate local employment, provide help for the unemployed.

— *Rural Development Commission* is concerned to alleviate economic and social problems in rural England. Its Rural Social Partnership Fund supports voluntary organisations in partnership with other agencies which aim to tackle problems of rural disadvantage.

- *Local and national trusts* are increasingly a useful source of funding for capital expenditure items but are less likely to provide revenue funding, except for innovative or experimental projects. Charities and trusts often have rules concerning what kind of project they can support. It is useful if you can find out what these are before applying since a little redrafting of your proposal could make it more acceptable. District Councils are supposed to keep a list of local charitable trusts and their terms of reference, but failing that the local CVS or RCC will usually be able to advise on possible sources of local funding. National trusts and their areas of interest are listed in *The directory of grant-making trusts*, an annual publication from the Charities Aid Foundation. You should find a copy in the reference section of most major public libraries.

Commercial organisations are unlikely to provide funding for the day-to-day running costs of an information service but may be a useful source of capital funding for equipment, furniture or special projects. They may also give help in kind—donations of redundant equipment, training, etc., or offer sponsorship deals for fundraising events and publicity.

The Public Library Development Scheme (PLDIS) was set up in 1988 to encourage new enterprises designed to extend or improve public library services in England. Activities likely to promote cooperation between public libraries and other libraries or organisations in the public or private sector are of particular interest. The Scheme is funded by the Department of National Heritage and administered by the British Library Research & Development Department. It was originally funded for three years, but in September 1990 the Minister for the Arts set aside up to £250,000 per year for the three financial years 1992/3-1994/5. The

Scheme provides up to 40% of the funding for projects, the remainder to be found by the library authority or other organisation and its partners. Types of project in the community information field that have been helped through this Scheme include a feasibility study and implementation of a Training Shop in Peterborough Central Library, and Camden's Free Leaflets Information Service.

The British Library, Research & Development Department has given support over the years to innovative community information services such as South Hackney School 'Right to Know' project and South Molton Community Information project. If your proposed information service intends to break new ground then you may be able to interest the British Library (BL) in a research proposal. It would, however, need to cover the research element of the work. Only in exceptional circumstances has the BL provided financial help towards the setting-up and running costs of projects. The Department has a five-year plan for priorities in research of which the broad areas of concern are the applications and implications of information technology, information as a tradable commodity, and the effects of economic and social constraints on services. Further details of current priorities are contained in their booklet, *Priorities for research* 1989-1994, available from The British Library Research and Development Department, 2 Sheraton Street, London WIV 4BH. Although most of the possible sources of funding listed above are for either capital items or relatively short-term running costs and do not solve the question of how to keep the service going in the long term, nevertheless they do make it possible to get services off the ground, to establish them on a sound footing and to demonstrate their worth to the community. Hopefully, this will then attract more secure and lasting financial support.

Services provided by local authorities are encouraged to pursue income generation as a means of supplementing or making up a shortfall in budgets. There does not appear to be much scope in the field of community information for income-generation activities, other than marginal activities such as the sale of mailing lists to commercial organisations. The one exception is in the provision of support activities, such as Camden's Free Leaflet Information Service, which is attracting support from libraries and other organisations nationwide through a subscription system. Other organisations like the National Association of Citizens' Advice Bureaux successfully market their information service but this does not represent a major proportion of their funding.

A community information service that is intended to be simply an extension of an existing statutory service will still need to be costed and the effect on other parts of the service assessed. It is highly unlikely that there will be spare capacity—either finance, staff or accommodation—lying around waiting to be used. A sufficiently well thought out and argued scheme might attract additional funding from the authority or via other sources of finance, but the most likely scenario is that it will have to be provided out of the existing budget. This then means that some kind of reassessment of current services must take place, in order that priority be given to the proposed service, and resources diverted to support it.

It hardly needs to be said that for such a process to take place and be successful, both senior management and staff in the workplace need to be convinced of the value of the new service and to be committed to its development. The climate for developing such services in public libraries in the mid-1990s is not of the best. Government legislation has focused attention on the 'core' services—lending books and providing reference and study facilities—and other services are expected to be self-financing. Pressure on local authority budgets as a result of rate-capping or the threat of it has meant a retraction of staff involved in outreach services, such as community information.

It is always a good principle to try to locate an information service where it will be most accessible for its users. Even in a 'closed' community, such as a school or organisation, there may be parts of the building that are natural congregating points, e.g. hall, refectory, social/recreational rooms, by the drinks machine. Obviously, the location of an information service which does not deal face-to-face with clients, but mainly via the telephone and post, is less crucial. Research into the use of advice centres indicates that most people use them because they are familiar and very local. They also tend to use those which are near their homes in preference to those which are near their workplaces.

So the ideal location for an information centre that is to serve the public is likely to be in the neighbourhood shopping area. This will not only make it accessible for the purposive user but should also encourage casual use, especially if it has windows that can be used to promote the service, Such locations, however, can rarely be afforded by one agency alone and you might need to consider sharing with other agencies.

With the recession at its height, there are vast numbers of shop premises lying empty which landlords Might consider letting on a short-term basis for a reduced rent. Sometimes district councils have empty property available for short-term lets. If obtaining your own prominently sited premises, either alone or shared, is out of the question, then consider the possibility of being housed by another organisation that already has premises in a suitable location, such as a library, community centre, council offices, nearly-new shop or even a commercial concern. Failing that, then the next best thing is to seek for premises where there is a significant traffic flow, even though it may not be with shops—for example near a popular bus stop, a school or clinic, on the way to a shopping centre, or in premises which regularly attract a large number of people.

An information service that is intended to help those with special needs, such as people with disabilities or elderly people, might be best located in a place where they already meet for other purposes—a day centre or workshop for the handicapped, for example. The following are some other features to look out for in locating a community information service:

- ground-floor accommodation for ease of access, especially for elderly and disabled people;
- prominent location—not tucked away in a back room or having rear access;
- facilities for display, such as a large picture-window;
- informal atmosphere—some buildings can look too official or have unpleasant associations which may constitute a deterrent to users;
- drop-in facility so that potential users, especially the more timid, have a legitimate reason for going into the centre for the first time to 'suss it out' without being challenged.

The space requirements for your community information service will depend very much on the type of activities it will be undertaking.

A *self-help service* makes little demand on office accommodation and does not require an enquiry desk, but will need a prominent location near the major traffic flow in the building and space for noticeboards and leaflet/display racks.

A *support service* or one that does not deal face-to-face with clientele may only need an office in any habitable location with space for processing materials.

A purely *information-giving service* dealing face-to-face with the public may need a waiting/ browsing area that is welcoming and relaxing, space for leaflet display and noticeboards, an enquiry desk prominently sited near to major traffic flow, and an office/workroom for the staff.

An *advice/counselling service,* in addition to the above, will need an interview room(s) for those clients who need privacy. Some advice services put more emphasis on informality and seek collective solutions to problems through group discussion, rather than through a one-to-one approach. Here, the centre becomes more a social facility, encouraging people to drop in for a cup of tea or coffee and a chat, out of which information needs can arise incidentally. This style of operation calls for a kitchen or at least, space where drinks can be made, and a comfortable lounge-type area.

Equipments

The importance of the enquiry desk being located near the main traffic flow has already been stated. It should be immediately visible on entering the building/room and clearly signed. Where the location is unfavourable, this can be overcome to some extent by good directional signs. The desk should be low and form the least possible barrier between the information seeker and the staff. It will need to have a fairly large surface to accommodate such things as card files and/or computer, telephone, frequently used quick-reference books, etc. Drawers will be needed for pens, stationery, frequently used information files and cash A chair will be required for the use of staff, preferably one that is adjustable if more than one person is going to use it, and with a swivel where the staff need to turn round frequently to consult shelves or a noticeboard.

The information service which handles a high volume of very quick enquiries, like a tourist information centre, might find it more convenient to have a higher bar-type counter with enquirers and staff either standing or using barstools.

Telephone is the most important item of equipment for the staff and the public in your information service. Some information services conduct most of their business with clients over the telephone. In such cases, where it is desirable to link a telephone enquirer immediately with another service, this can be achieved by means of a three-way or conference-line facility. The most useful location for the telephone is on the enquiry desk, although further lines or extensions may be required in interview rooms or offices. Opinions differ as to the desirability of having telephones in interview rooms. In some instances, when seeking information or trying to sort out a problem with another organisation on behalf of a client, it can be helpful to have the client by the phone so that points can be clarified as soon as they arise.

There will be occasions when you will want to talk frankly to another organisation without the client overhearing; in which case it is better if the telephone is located in a private office. Ideally, both options should be available but if this is not possible, then you will have to decide on the basis of which will cause the least inconvenience. Where possible, your information service should have its own separate telephone line so that clients can make contact direct without having to go through a switchboard or waiting for lines to become available. If that is not possible, then an extension exclusively for the information service is the next best thing. It is helpful if you can obtain a telephone number that is easily remembered by users. There are several instances where people living in more remote areas have been provided with free telephone access to a central information service through the installation of a direct line from a public building, e.g. a branch library. This has been used as an alternative to providing an extension bureau or to compensate for the withdrawal of local offices. The main space requirements would be for a soundproof booth or office.

Some information services, who need to recover the costs of providing information, are using pay lines, whereby the customer pays not only the cost of the call but also a fee for accessing the information. In these cases, the information is usually provided by means of recorded tape(s). Details of free telephone access services and pay lines can be obtained from your local British Telecom office. You may consider that it is important for your information service to be able to offer help outside its normal opening hours. In this case you will need to install a telephone answering machine, so that at any hour of the day or night when the service is closed, enquirers can leave messages. Some answering machines also enable you to record a message or information which is played back to callers when they ring the service.

Computers are within the reach of most information services, they are looked on as being a necessity rather than a luxury. However, if the computer is needed solely for the organisation of information, then it may only be of value where you have a particularly large database or need to access the information through a variety of search terms, Otherwise a card index system could be cheaper, quicker to consult and more user-friendly. Generally, a computer is needed for a variety of functions, e.g. maintaining client records, keeping statistics, correspondence, accessing online databases, designing publicity, and so on.

If you are not using a- computer for storing your information, it is most likely that your information file will be kept on cards, the most popular sizes being 5in × 3in (127mm × 76mm), 6in × 4in (152mm × 102mm) or 8in × 5in (203mm × 127mm). These cards will need to be housed either in drawers in a wooden or metal cabinet or in open boxes/drawers (wooden or cardboard). Open cardboard boxes designed for card filing are fairly cheap and can be found at most office equipment suppliers. If you are really desperate, shoe boxes make a good substitute. Open wooden boxes are much more expensive but anyone with a smattering of carpentry should be able to knock up some from offcuts of wood. They don't need to be very sophisticated or load-bearing. Open boxes are easy to access and, with appropriate guiding, display the information clearly, but they also have some disadvantages: it is not convenient to stack one on top of the other; they are open to dust, drips from coffee cups, discarded chewing-gum and other unmentionable objects; and, if knocked over, the cards spill out and you have the tiresome job of re-filing them.

Card drawers overcome these problems, even if the information is slightly less accessible. Again, you can get cheap drawers made of cardboard or expensive ones in wood but the most common type is the two- and four-drawer metal filing cabinet. Each drawer holds approximately 1,000 cards and, if you need greater capacity now or later, units can be stacked one on top of the other. Some drawers have a rod which holds the cards in place but this can be a nuisance if you need to take cards out frequently for updating or have information on the back of cards. For even greater storage capacity you will need to consider a free-standing metal or wooden cabinet, but these can be expensive items. With more and more public libraries going over to microfiche or computer catalogues, there may well be an opportunity to pick up such a cabinet at a knock-down price.

There are on the market other more sophisticated files which usually have their own specially shaped cards. If you decide to buy one of these, you will need to take account not only of the cost of the equipment but also of the continuing cost of the specialized stationery. The systems described previously use standard sizes, so that it is possible to use scrap cards or print your own with a predetermined grid to save costs. One card unit that does have some useful features is the Rondofile which, as the name suggests, works on a turntable system, enabling the user to consult a large number of cards from one sitting position. Cards are easily removed for amendment and are available in a variety of colours, so it is possible to introduce an elementary colour-coding of information, say by area, subject or type of organisation. A Rondofile is compact enough to be housed on the enquiry desk and thus can also be accessible to the public, if desired. One file holds 1,000 cards and, if more capacity is required, a second unit can be stacked on top. For details and up-to-date prices of Rondofiles contact M Myers & Sons Ltd, PO Box 16, Vicarage Street, Langley Green, Oldbury, Warley, West Midlands B68 8HF. The same firm has other card filing systems, including the Rondex, a rotating desktop file that holds up to 1,000 cards, available in three versions to take any of the standard card sizes referred to above. A similar card filing system using a vertical rotary action is made by Rotadex Systems Ltd, 3/5 Fortnum Close, Kitts Green, Birmingham B33 0JL. There are 24 models in the range suitable for five different card sizes, the largest housing 9,000 cards.

Filing cabinets and dividers will be needed for keeping flimsy publications such as pamphlets, leaflets, broadsheets posters, etc. as well as correspondence.

Cabinets come in one-, two-: three- or four-drawer units, usually in metal, although there are some cheap cardboard ones on the market. At a pinch you could always make do with cardboard boxes and used manila envelopes!

Virtually every information service will have some reference books, varying from a mere handful to many hundreds of volumes. Small numbers can be kept on the enquiry desk itself using bookends, a book slope, or one of those lethal coiled-spring contraptions. Slightly more could be housed on a book trolley and sited conveniently near the desk for quick reference. Larger numbers will require some form of book shelving, even if it is only cardboard or wooden cartons laid on their side or planks suspended across house bricks. There are an infinite number of commercially made metal and wooden shelving units, either free-standing or wall mounted. Your local library should be able to help you with addresses of library furniture and equipment suppliers. Their shelving tends to be more substantial and you may find that bookshop type shelving is both adequate, attractive and cheaper.

Some of the major furniture retailers, like Habitat or MFI, have cheap shelving available in a range of bright colours. Sloping shelves may be needed for displaying magazines, leaflets or information packs face outwards. Most modem library shelving systems have facilities to incorporate sloping shelves. Murrell's and Point Eight also do sloping shelf units, either freestanding or wall mounted.

Noticeboards are needed for displaying posters and information sheets for your clientele. Rarely does a community information service have sufficient noticeboard space, so be generous in your estimate where funds allow. Nothing looks worse than seeing a noticeboard with posters all higgledy-piggledy and overlaping. For cheapness, buy a large sheet of pin-board and cut to size to fill empty wall spaces, pillars, doors, etc. Boards do not need too smart a finish since most of the time they will be hidden by posters.

A noticeboard standing or hanging in a window of your centre and visible to the public can be used to feature special events, information campaigns, surgeries, or out-of-hours information. Alternatively, consider using a mobile blackboard or external wall-mounted noticeboard for this purpose. External noticeboards are best covered, using vandal-proof glass or perspex.

Considering the vast number of leaflets available of all, shapes and sizes, the choice of ready-made equipment for displaying them is not wide and what does exist is often expensive. All the more reason for trying to make your own. The following are two cheap suggestions:

— Cut stiff manila envelopes of the size required to make pockets, glue them in rows on a large piece of card and pin this onto a wall or noticeboard. An alternative material to use for pockets is adjustable book jacketing, which has an added advantage in allowing all the leaflet to be seen through the plastic front.

— Screw cup hooks into a sheet of blockboard or similar material, attach to a wall, and hang leaflets from the hooks by punching a hole in the top of 'them. A copy of the cover of each leaflet could be pasted onto the board to act as an aide memoire when stocks have all been taken.

Display boards will be needed if you intend to put on free-standing exhibitions or displays. There are innumerable makes available in a variety of price ranges, many offering special features or accessories. It would pay you to look around first and get advice from someone in the know, such as the publicity officer of a local authority, large firm or other public body. Consider such matters as portability and stability—particularly if you are going to use the boards outside the centre or outdoors—and ease of assembly. If any display boards can be said to be universal, then it must be those of Marler Haley Exposystems Ltd, who do several different systems that are easy to erect, versatile and attractive.

Strip indexes may be used as an alternative to card files or as a way of presenting information for customers to use. They are limited as to the amount of information that can be contained on a strip, although a variety of widths is available. Strips are more awkward to interfile and update but they have the advantage that it is possible to photocopy quite easily the whole file or sections on demand. As personal computers (PCs) become more universally available, it is difficult to see a future for strip indexes. Kalamazoo do a variety of holders and strips but these are a little expensive.

It is possible to list a great many other items of furniture and equipment that a community information service might need, depending on the nature of the service, the resources available, and the existence or otherwise of backup secretarial help. Simply note a few items that may be considered: (a) pigeonholes for storing leaflets; (b) bench or flat surface for assembling packs or publications; (c) typewriter; (d) photocopier (be very careful about leasing a photocopier—preferably get legal advice before signing any contract); (e) machine for recording number of users/enquiries; (f) fax; (g) duplicator.

Pamphlet boxes may be needed for storing booklets, leaflets and other ephemeral materials for use by staff or clientele. They are available in several sizes and varying quality, from cardboard to plastic, closed or open at the top. Lawtons Ltd, 60 Vauxhall Road, Liverpool L69 3AU do a cheap A4-size cardboard pamphlet box, called the Lawco Box, which comes flat and is then folded into shape. A more up-market A4 fold-up file box in brightly coloured plastic-covered card is produced by Esselte Dymo Ltd, Spur Road, Feltham, Middlesex TW14 0TR. The same firm also has a more rigid polystyrene plastic pamphlet/magazine file box in bright colours, sizes A4 and A5. Library stationery suppliers also have ranges of pamphlet boxes on offer.

Manila folders and envelopes are needs to file cuttings, leaflets, information sheets in vertical files. Plastic wallets are even better, if you can afford them, as they enable the contents to be immediately visible. They are particularly useful if you want to go in for compiling information packs for your clients. Celsur Plastics Ltd, Drake Avenue, Gresham Road, Staines, Middlesex TW18 2AW have them available in clear and opaque plastic to take A4 documents, and can produce other sizes to your specifications.

5in × 3in cards needed for subject indexes or brief information, 6in × 4in, and 8in × 5in for recording more detailed information about organisations and services. Cards can be overprinted with a grid for entering information in a standard form. Use scrap cards for cheapness or 'greenness'. Cards are available from most office stationers.

Need for an information service

Before setting up an information service, you should ask yourself, first of all, some very basic questions—like those a journalist asks when writing a story: who?, what?, when?, where?, why?, and how?—but not necessarily in that order. Surprisingly, there are many instances where these questions have not been asked and services have been set up which were either not wanted, the wrong type of service to meet clients' needs, a duplication of already existing services, too ambitious for available staffing or resources, or lacking in commitment from the organisations management or staff.

The moral is that careful thought and preparation at the outset can save a lot of wasted effort and be the sound foundation on which to build a successful service. It is always better to start modestly and grow, than to be too ambitious and have to retract or fail completely. This book tries to follow the same principle in the way its information is presented, moving from simple, cheap solutions to the more sophisticated.

Everybody has information needs but not everybody is equally capable of satisfying those needs. This is increasingly so in what has been termed our 'information society', with its complexity and rapidly accelerating rate of political, social and economic change. Information is now also seen as a commodity, with a market value that may well put it beyond the reach of the 'have-nots'. More and more, it is being made available in electronic forms which may require the possession of special skills on the part of those wishing to access it. Therefore, a good reason for setting up an information service may well be to make it easier for individuals or groups of people who do not have their own adequate information networks to gain access to information that can be of benefit to them.

The need for an information service be readily apparent or clearly voiced by your clientele. More often than not, that need will have to be identified and assessed. There are several ways of finding out who needs an information service, ranging from the simple to the sophisticated. Here are a few methods you may care to consider:

Talk to the gatekeepers in your community—these are the people to whom, because of the nature of their work, their knowledge, approachability or status, others go for information and advice. A typical list of 'gatekeepers' might include community workers, trade union stewards, youth leaders, headteachers, Women's Institute secretaries, or GPs. A word of caution: you should not rely on the views of these people alone, as they may well be biased or blinkered.

Find out if there are any groups which represent the people you wish to serve, as they will most likely be aware of the needs of their members or of the community. Particularly useful arc 'umbrella' groups like Councils for Voluntary Service (CVSs), Rural Community Councils (RCCs), councils for the disabled, trades councils, and community associations. Look out also for less formal groups such as luncheon clubs for community workers, youth leaders or advice workers. Attending meetings of groups like these will give you a feel for the kind of problems that arise and for which provision is lacking. Such meetings might also be a useful forum to discuss the need for any proposed information service. If your 'community' is a closed one, such as the staff of a particular organisation, then it is important for you as information officer or librarian to be thoroughly conversant with the issues of concern to that organisation. One way of achieving this more quickly is to have the right to sit in on committee meetings. This will help in identifying what the organisation's information needs are likely to be and how to meet them.

Arrange an informal meeting of representatives of groups in your community and other interested or useful people, at which you can discuss your ideas for an information service and then take things further if there is a positive response. Out of this meeting might well be set up a steering committee or working group which could canvass wider opinion, either informally by calling an open meeting, or by conducting a survey of the community. Such a group might also prepare a feasibility study. Call an open meeting at which your 'community' can hear about the proposals and make comments. If the meeting is not being called by the kind of steering committee suggested above, in some circumstances it may be helpful for it to be held under the auspices of a neutral body; for example, where your organisation, rightly or wrongly, is perceived by the community as representing one particular viewpoint. Wide publicity for the meeting is essential, using whatever means are available—word of mouth, posters, leaflets, local press, periodicals, newsletters, etc.

Any publicity should give details of what the meeting is about, when and where it is being held and at what time it starts. Choose a date and venue that is convenient to most of the people you want to reach, taking care to avoid other events or activities that are likely to prove a counter-attraction. This may even apply to what is on television at the time! It is wise to give some thought to the ambience of the venue for, in some cases, an imposing room or 'official' building may inhibit attendance or discussion. If at all possible, avoid holding the meeting in a room that is not accessible to disabled people.

Refreshments, if only a cup of coffee, help to stimulate a feeling of informality and encourage discussion. Put yourself in the place of someone who might attend the meeting and ask what would attract you. Make careful preparations before the meeting takes place, including a plan of how you would like the meeting to be structured, so that discussion does not waffle on aimlessly and yet is flexible enough to encourage responses from the audience. Graphic displays, audiovisual presentations and speakers from similar projects elsewhere can add another dimension and help to get your proposals across.

Conduct a survey of potential users to establish their information needs. This can be done instead of or in addition to holding an open meeting. It is essential from the start that you have a clear idea of what you want to learn from the survey and at whom it is aimed, for this will determine the kind of questions you will want to ask and the form in which you present them.

It is a good principle always to try to make the wording simple and unambiguous, with alternatives spelled out where appropriate, as in the example from South Molton shown here which was used to establish the need for a multi-agency information and advice service in a small market, own in Devon. When Terence Brake set up a community information service at South Hackney School in London, he rightly surmised that many of the pupils would not understand or use the term 'information' and some might even react with hostility to an emotive word like 'need'. Consequently, he devised a range of simple questionnaires related to the youngsters' interests, such as the one on use of leisure time illustrated here which elicit the information in a way which is less formal and with which the young people can identify. The drafting of surveys and questionnaires requires a degree of skill not possible to examine here, but if you would like to know more, the following books should help. The method of distributing your survey questionnaire needs careful attention. Ideally, it helps if you can be present when the respondent fills in the form, so that any points or questions not understood can be clarified.

Often valuable information is imparted verbally through hints and nuances of conversation that would not be transmitted on paper. However, the ideal is seldom attainable and you may have to be content with mailing out your questionnaires. This obviously saves time but you should not expect a very high response rate. It helps, of course, Where you can afford it, to include a reply-paid envelope for return of the form. Surveys can be a help in pointing you in the right direction or by adding weight to already formative ideas; however, they should not be used on their own, but only in relation to evidence obtained by other methods.

Analyse enquiry statistics to see if there is a demand from any particular group of user which requires special attention, such as a separate information or advice service. For example, recent years have witnessed the introduction of debt counselling services by Citizens' Advice Bureaux as a response to a vast increase in enquiries in this area. Your organisation may already be operating a more traditional reference or information service. An analysis of its enquiries over a period of time, if these are kept in sufficient detail, may indicate areas of need not being adequately met. An alternative, if your statistics are not detailed enough, is to carry out a short-term monitoring exercise. As well as your own statistics, you might get some help from those of other information and advice agencies operating in your area of interest. By using some or all of the above methods you should have arrived at an idea of the information needs of your community.

However, before making a decision on the kind of service required to meet those needs, it is essential to have as complete a picture of your community as possible. The best way to achieve this is to compile a community profile. This is a systematic process developed initially by corporate planners and adopted by other agencies, including public librarians, to enable them to plan and provide services which meet the needs of a given community.

A typical profile will include:

1) *Statistical data* about the population: size, rate of growth, age ranges, sex, marital status, religion, ethnic groups, diseases and mortality, employment, education, housing, etc. Much of this information is obtainable from census documents, supplemented and updated by figures from local authority departments, health authorities, employment centres, police, etc.
2) *Socioeconomic information:* types of economic activity, community services—statutory, voluntary or private, recreational facilities, meeting places, clubs and societies, etc.
3) *Local issues:* redevelopment, unemployment, poor housing, transport problems, racial prejudice, etc.
4) *Residents' viewpoints:* letters to the press, community newspapers, local radio and TV, action groups, community noticeboards, graffiti, informal discussions with those who come into contact with a wide cross-section of the community, informal contacts in pubs, shops, public meetings, etc.

Community profiles were initially designed for analysing geographical communities but the same principles will apply, although the techniques and sources of information may vary, if your community is a 'closed' one, such as a school or organisation, or a group with special needs, like elderly or disabled people. There are also some spin-offs from compiling a community profile. If you do decide to go ahead and set up an information service, the information gathered for the profile could form the basis of your local information file and might also be made available to your clientele in printed form. The valuable contacts made with individuals and groups will form the basis for your information network.

There is one more step that needs to be taken before you can get down to putting flesh on your ideas and that is to find out if there are any other agencies in your area operating identical or similar services to the one that you are planning. You may, in fact, want to take this step at an earlier stage or you might have found out the information in the course of conducting a community profile.

It is an important stage that should not be omitted, since it is in nobody's interest to duplicate existing services, especially if there are gaps in provision elsewhere. Information about existing services in a particular neighbourhood can be collected by means of a questionnaire. This will give you only the bare outlines and will need to be expanded by personal visits. The kind of information you will need to collect about each agency consists of the following:

- location, premises and equipment, opening hours, how to contact the agency;
- staffing, information resources, training;
- the agency's activities;
- referrals, relationship with other agencies;
- the agency's users;
- feedback to policy-makers;
- publicity;
- management and funding.

The costs of providing an information service rise continually and finding for many organisations is frequently precarious. Material support or behind-the-scenes lobbying to help existing services will usually be more than welcome. The solution to meeting the information needs of your community does not necessarily have to be your direct responsibility. It may not be appropriate, anyway, if your staff do not have the training, flexibility, time or independence to provide the kind of service that is required. There may well be an existing information and advice service which is prevented from providing an adequate service or extending its work through badly located premises or lack of funds for staffing, training, information resources, etc.

Public libraries could explore ways of putting their extensive information resources, both materials and staff, at the service of other information and advice agencies by agreeing to keep and update files of local information or by producing a directory of local information and advice services. Often several agencies in a community will be collecting local information. This is wasted effort, as the information needs to be collected only once, and causes annoyance to those supplying the information. A joint approach is called for, either one organisation collecting the information on behalf of the others, or a consortium of organisations sharing the task.

There are distinct advantages in several agencies sharing premises, in addition to that of economy. It provides better access for the public who can see a number of agencies in one place without a time-consuming and often expensive run-around. Referral is made easier, which is particularly useful in multi-problem cases. There is the possibility of not only shared accommodation but also shared information resources, shared publicity, shared case-notes, etc. Sharing can make the service available for longer hours than one agency on its own could possibly attain.

Cooperation of the kind listed in this section can be fostered by the formation of an 'umbrella' group which brings together all the community information agencies in a particular community or area of interest. Such a group could take on activities such as information sharing, joint collection of information, cooperative approach to funding, shared publicity, training and generally creating a greater awareness and understanding of each other's work. Sometimes a number of agencies in an area, who are heavily involved in handling problems of a particular kind and do not have the resources or time to cope adequately with them, can benefit from the creation of a specialist support group to provide training, research, practical assistance, information materials, current awareness services, or expertise in certain areas, such as law, debt counselling, housing, planning, tax, etc.

Face-to-face contact with clientele is a passive function, whereby a community information service is located in a particular building or room and the clientele call in person to seek information for themselves or from the staff by enquiry at an information desk. It has the advantages that the most up-to-date information is available, provided the service has carried out its information-gathering efficiently; the client can be questioned to reveal exactly what information is required; and a member of staff familiar with using the files or databases is on hand to search out information, to make contact with services, or to suggest further possible courses of action.

Many people prefer information to be transmitted verbally, especially if they have low literacy skills. Some disadvantages to having one defined location are that, unless it is prominently sited, it may be difficult to bring the service to the attention of potential users without a continual publicity campaign; moreover, it can be expensive to operate in terms of the resources needed to staff the enquiry desk continually and to stay open outside normal office hours. Dealing with people face-to-face requires a certain amount of skill but, above all, is needed a pleasant and approachable personality, a characteristic that is not so easily learnt.

The following guidelines may be helpful in dealing with clients:

— Try to make the enquirer feel at ease, so that s/he is not afraid to ask questions or discuss a problem. It may seem a trivial enquiry to you but could be causing the client much anxiety.

— Do not exhibit feelings of shock, horror, amusement, disbelief or repugnance at anything the enquirer says. It is not part of your job to pass judgment on a client whose behaviour or ideas are contrary to the norms of society.

— Listen to the whole query and don't start jumping to conclusions before the enquirer has finished. Listen 'actively' by asking appropriate questions to clarify what is specifically being asked, since most people tend to phrase their questions in general terms.

— When you think you know what is being requested, state it in simple terms so that the enquirer can confirm that you are on the right track.

— Try to identify with the enquirer's problem, at the same time remaining impartial and emotionally uninvolved. Such a counsel of perfection is probably unattainable but is only a warning that sometimes people ask the impossible or want confirmation or support for a course of action when they are in the wrong.

— Before any information is given it should, wherever possible, be double-checked to ensure that it is correct and, if reasonably brief, written down to give to the client.

— Where there are alternative courses of action, explain these to the client in simple terms and leave her/him to make the choice unless you are specifically offering an advice service.

— Never leave the client with a negative response even when you cannot answer the query. Suggest where else the client may go to find an answer, even making a telephone call, if necessary, to fix an appointment or make an introduction. If the enquiry needs further investigation and is not urgent, take down the details and offer to phone or write with the answer as soon as possible.

The facility to transmit information by telephone can be an advantage, especially where clientele have difficulty in reaching your service because of its location, hours of opening or their own physical disabilities. Some people actually prefer the greater anonymity of the telephone. The physical location of a community information service whose work is mainly or entirely conducted on the telephone is less important. Staff can be occupied with other work in between calls and do not have to be tied to an enquiry desk; thus it may be possible to offer longer hours. With the additional use of an answerphone, a service could offer a 24-hour, sevendays-a-week service.

A conference-phone facility enables three-way link-ups to be made and clients can be put in direct contact with a service that can help them. If in order to answer enquiries you need to move away from the telephone or for periods of time it has to be left unstaffed, then you may need to consider the convenience of a cordless phone. However, telephones are still by no means universally available in Britain and public call-boxes are frequently inconvenient because of location, continual use or lack of privacy. Some people are deterred from using telephones because they experience difficulties in expressing themselves via this medium or the cost of making calls is a financial burden. Some services have overcome the latter difficulty by offering a Freephone or 0800 number, or by a policy of ringing back the caller as soon as contact is made.

Telephones are best suited for answering enquiries that are brief, clearly stated and uncomplicated. Time does not allow for lengthy interviewing of the client over the phone, nor is it possible to pick up those nonverbal signals which often help in assessing the true need of the client. Likewise, the client cannot see you—so make your voice welcoming.

Requests for information by post do not as a rule figure prominently in the work of a community information service, but they are just as important. There is a temptation to assume that postal enquiries are less urgent than the client who is breathing down your neck or hanging on the end of a telephone, and so can be dealt with whenever there is a spare moment—in other words, never! However, every enquiry is important to the person making it and should be dealt with expeditiously. A fairly common type of postal enquiry from individuals, organisations and commercial concerns is for lists of clubs and societies on a particular topic or in a particular area. It is obviously an advantage if you have a filing system or a computer database which enables you to print out a section on request. An alternative for frequently requested information is to have it pre-printed as a list, broadsheet or leaflet.

An information service can take advantage of this by providing well-sited, attractive and interesting displays for putting over information to clients and passers-by. There are four main aspects of display: noticeboards; thematic displays; window displays; and outside display.

A great deal of information is available in poster or broadsheet format. Some of it is free, some will come unsolicited and there are a few posters for which you have to pay. There are basically four types of poster:

1) The event poster gives details of something that is to take place at a particular time;

2) The service poster gives details of a service that is available—its opening hours, location, who is eligible, how to contact, etc.—and is not, as a rule, restricted to a finite date;
3) The information poster presents hard information in an encapsulated form—benefit rates, changes in legislation, health education, eligibility for grants, etc.;
4) The persuasive poster seeks to sell a product, change opinions, or enlist sympathies.

The displaying of posters is an activity that can frequently arouse great passion, particularly those posters concerned with moral, political or religious issues on which strong opposing views are held. This applies not only to campaigning posters but also to ones presenting straightforward information, such as an event or hours of opening of a service, e.g. family planning clinic. You need also to be sensitive to the location of a poster. A poster showing how to fit a condom may be appropriate for display in a youth information centre but not on a board just outside the children's library.

Ideally, a community information service or its parent organisation should draw up guidelines on what is or is not allowed to be displayed. Try to avoid the overly simplistic approach of displaying either everything or nothing at all.

An open door policy may, in theory, sound fine but in practice it can throw up just as many problems, such as your right to refuse to display a poster which may not be in the public interest but does not necessarily contravene the law. It has been usual to rule out commercial advertising posters, although some services now accept these but make a charge in order to raise money for the service. There is more to displaying posters or other notices than simply sticking in a few pins.

Displays devoted to a particular topic or theme, if well produced, can be a useful way of drawing attention to information that is available. The theme may (a) concern a problem area identified from an analysis of enquiries; (b) relate to a current change in legislation or benefit rates; (c) be aimed at improving public awareness of an issue of current concern; (d) draw attention to benefits, grants, services or rights of which your clientele may not be aware; (e) canvass support for a cause; or (0 educate your clientele on personal matters, e.g. health, finance, etc. Use noticeboards or—better still—freestanding boards to mount displays. There is some skill required in preparing materials and mounting an effective and attractive -display. Identify someone in your organisation who has a flair for this kind of work and is willing to help. There are a number of organisations and government departments which have displays that can be borrowed free of charge or with carriage paid one way.

If your information centre is blessed with large windows looking onto a thoroughfare, then they can be used to good effect in giving out information not only to users of your service but also to casual passers-by. Displays such as those described in the section above, placed in the window, enable the information to reach beyond your own clientele and may even attract use of the service.

An external window can also be used for displaying essential information when your service is closed, such as addresses and telephone numbers of emergency services, hotel or bed-and- breakfast accommodation. A number of commercial organisations have produced microcomputer-driven information points which usually stand in a window and feature local information and advertising. The computer either scrolls pages automatically or is controlled by means of touch terminals mounted on the outside of the window.

Windows or glass entrance doors may be also be used to display small ads and job vacancies.

Small ads may seem trivial but they do fill an important information need in most communities and also have an added bonus of attracting people to look in your window and, perhaps, thereby become more aware of the service and of what it can offer. Small ads can also be a useful source of income for your service but, in setting up such a service, be sensitive to other small ads services in the immediate vicinity. A job vacancies board is a much appreciated service, particularly at times of high unemployment and where your service is located some distance from the nearest job-centre.

Either contact local firms, businesses, shops, etc. and ask if they would be prepared to display their job vacancies in your window—you might even make a charge and earn a bit of income for the service - or contact your local Jobcentre who may be prepared to let you have job vacancy cards on a regular basis. If you can afford to do so, offer to contact the firm or Jobcentre on behalf of any client who is interested in a particular job advertised, to see if it is still vacant.

As well as displaying information in your own centre, consider the possibilities of display in other buildings. It may be possible to circulate such displays around a number of centres and thus reach a much wider audience. Some commercial businesses, like banks and building societies, who rarely have anything interesting to show in their windows, encourage organisations to use these for displays.

With displays located on other people's premises, you will have to accept their right to reject all or part of your display if it is objectionable to them or not produced to a high enough standard. Find out first if the organisation or business has a policy on what can or cannot be displayed and whether they have their own display equipment which you can use.

For outside displays, other than simply posters pinned to a wall, you will need spare display boards that can be released for a length of time and the means of transporting them. The display should be checked regularly to maintain stocks of any give-away leaflets, etc., to ensure the currency of the information, and to keep it in good repair. Another possible outlet for information is community noticeboards, which are usually located in prominent positions such as market squares, shopping malls, etc. They are most likely to be owned by the local council but it is not unknown for councils to assign the running of them to a local information centre.

Selective Dissemination of Information (SDI) simply means taking note of the subject interests of particular individuals or groups who use your service and supplying them with new information on their areas of interest as it becomes available. 'Taking note' can be a fairly organized and formal system involving the sending out of a questionnaire initially to discover users' interests and maintaining a card or computer file of those interests. However, more often than not, it is an informal system stored in the information worker's head. Good information workers can even anticipate the interests of their clientele.

SDI is most often used by services whose clientele are a closed group—a voluntary organisation, for example—rather than ones who serve the general public. Where generalist services operate SDI, it will usually be for other information and advice workers, community workers, professionals or groups. An SDI service can include regular scanning of new publications, journals, newspapers, press releases, annual reports, product literature and other ephemeral material or it may be rather unsystematic and random. Either way, it is a useful service, particularly for those individuals, organisations and groups who need a supply of new information in their area of interest but do not have the time, resources or expertise to search it out. It is an excellent way to win friends for your information service who in turn may be able to help you on other occasions. One solution to the problem of having one fixed location from which to give out information is to duplicate your information file or database and make it available to other centres. This would make it more accessible to a wider clientele but has the disadvantages that:

1) you need to have a mechanism for keeping these files or databases up to date, especially if you have to rely on someone else to do the updating,
2) staff, where they exist, need to be trained in using the file or database so that they can help clients. Files using loose-leaf binders or strip indexes are easier to duplicate than card files.

Computer databases can easily be copied onto floppy disk but depend on the recipient having compatible equipment. Those information services whose databases are stored on a mainframe computer may be able to offer other centres online access. Some community information services have made available collections of books and other material for deposit in centres which have particular needs, such as youth clubs. This is quite a costly service to provide in terms of both resources and staff time in preparing the collections and keeping them up to date. With this type of service, it is desirable to have a monitoring mechanism so that the value of the collections can be appraised. A good example of an information service that is duplicated and made widely available is that operated by NACAB. The material consists of specially prepared loose-leaf information sheets; leaflets and booklets; reference books; a comprehensive index; and other supplementary material, such as sources of leaflets and information about useful reference books. The system is updated by means of monthly packs containing amendments to the information sheets and leaflets; new information sheets and leaflets; a booklist of new publications; *Update*—a magazine which provides a comprehensive summary of changes in the law, etc.; and new editions of reference books.

As the system is so comprehensive, it provides the factual resource for a wide range of advice and counselling services. However, it does require a substantial amount of staff time to update the files each month and occupies several feet of shelving or a whole four-drawer filing cabinet. For many organisations the costs may also be prohibitive: £644 (voluntary organisations), £900 statutory and commercial bodies) to set up the system, while the annual updating subscription from April 1993 is 040 (voluntary) and £566 (statutory and commercial).

For those organisations who do not have this kind of money or do not need such detailed information, NACAB also produces a Basic Pack, contained in two loose-leaf binders, costing £29.50 (voluntary), £ 78.50 (statutory and commercial) to set up, with the annual updating subscription costing £37.00 (voluntary) and £61.50 (statutory and commercial). Further details can be obtained from NACAB, 115-123 Pentonville Road, London NI 9LZ. If your problem is lack of space or staff time to update the hard-copy version or you need an information system that is portable, NACAB also caters for these needs with a microfiche version of the hard-copy pack. Microfiche are 6in × 4in transparent cards which contain up to 60 pages of information.

These are one of the best means of making your information more accessible to a wider range of people than you could ever hope to reach through a static service point. Well-produced and attractive publications enhance the image of an information service and help to attract custom. The commitment of information to print inevitably attracts corrections, additions, etc. which enable your service to maintain an even more accurate and up-to-date database.

Producing publications of reasonable quality can be costly in terms of both time and money, depending on the system used for storing your information base and access to in-house printing facilities. If you have a word-processing or desktop publishing package on the same computer or access to these within your organisation, it may be possible to transfer the whole or sections of the database file into these packages and manipulate them to produce the required format and layout for publication; at which point there are again several choices:

— print out the publication on demand or in small quantities—not practical for lengthy documents;

— print off one copy on your computer printer and photocopy best for short documents with a limited run where quality is not critical;

— produce printed master copy for printing in-house or by a commercial printer using offset litho—master copy needs to be produced on good quality laser or bubblejet printer.

— copy the document to a floppy disk and take it to a printer who has equipment and software compatible with yours.

If you don't have access to word processing or desktop publishing, you may still be able to copy your database or sections of it to a floppy disk which can be read by a commercial printer with compatible equipment. The production costs will be higher as the printer will need to format, design or lay out the publication according to your specifications.

When you are planning the computerisation of your information system, it is worth ensuring that all your software packages are compatible not only on your computer but also with systems that are to be found in most printing firms nowadays. It may be worth investing A little more to get an integrated package that offers a suite of facilities—database, word processing, spreadsheet, graphics and communications service—that allows you to swap documents or bits of documents from one facility to another with ease.

If you have a manual database then a lot more work is necessary to transcribe the data into a form suitable for printing. Once you are at that stage, and if you do not have in-house printing facilities, it will pay you to shop around for printers. Get at least three estimates - you may be surprised at the variations in both price and the size of the publication. Ask to see examples of the printer's work so that you can get an idea of quality. If you have a limited budget, look out for community printers or resource centres which offer services at virtually cost price of materials, though you may have to do much of the work yourself. Alternatively, explore the possibilities of: (a) joint publication with other organisations; (b) obtaining a grant from an appropriate body who may have an interest in your publication; (c) sponsorship; and (d) advertising, or a combination of these. Once information is printed, it is static and, therefore, liable to date in a short space of time.

When producing a publication always consider your ability to sustain not only one issue but also any future new editions which may be necessary, to distribute copies, either as a one-off or regularly, or to handle sales. All these can be very time-consuming. It is an acceptable strategy, of course, to publish one issue in the hopes that its value will be recognized and future issues will attract funding. The frequency with which you need to update the publication should determine the format you choose—whether it should be loose-leaf or not, a leaflet or a booklet. Publications may be aimed at basically two kinds of user: those whose work or status consists wholly or in part in informing others and those whom we might term your general clientele. They may be the public, a section of the public, or members of a particular organisation or group. The major differences between the two in respect of publications will lie in the degree of detail and the way the information is presented.

A leaflet in one respect is a kind of extrovert list; it goes out of its way to attract attention—and thus encourage people to pick it up -through design and format. This is the information type of leaflet, the contents, of, which may be much the same as a list. The two other main, types are the educational leaflet, the objective of which is to increase understanding or awareness of a particular subject, and the campaigning leaflet, which sets out either to convert someone from one point of view to another, to gain sympathy and support for a cause, or to change a certain state of affairs for the better. Thousands of leaflets are produced each year by all kinds of organisations.

The quality of these leaflets varies from the extremely glossy and eye-catching to the cheap and nasty. If you are going to enter this arena, then it is important to give as much attention as possible to the design of your leaflets as to their contents, since they will have to compete for attention with commercially designed products. However, you do not have to be an artist or designer to be able to produce an attractive leaflet. Look around at examples of commercially produced leaflets for inspiration.

Advertising can also be a source of abundant 'free' or non-attributable art to illustrate and add impact to your own leaflets. Other sources of material might include old engravings (particularly of the Victorian era), drawings of the great masters (Leonardo da Vinci, Durer, Michelangelo, etc.) and instant art books. If you have access to a computer, the possibility is opened up to you of investing in a graphics package which enables you to draw and design your own artwork or to buy in copyright-free art files that can be manipulated for your own purposes. Lettering in a wide variety of styles which can be rubbed onto artwork is available in large and small sheets from most stationers, or your organisation may well have invested in a lettering machine.

Use cartoons, diagrams, graphs and photographs to liven up the text. Keep wording simple and short. Standard sizes of leaflets are A5 (149mm × 210mm) and 1/3A4, but experiment with unusual sizes based on standard sheets for added impact. Have enough copies printed to give a wide circulation and distribute them through as many outlets as possible, particularly those which attract large numbers of people. If the leaflet is aimed at a particular group in the community, identify specific ways of reaching them. Investigate other means of distribution that might give you an even wider coverage, such as insertion in a free community newspaper, with the council rates demand, or through organisations which regularly send out to a large mailing list.

Posters aimed to present a small amount of information with the maximum amount of impact so that 'he who runs may read'. Use posters to advertise events or your service, to draw attention to a few sources of information and advice, or to point out eligibility for a service or benefit. Much of the advice given above about the design of leaflets applies equally to designing posters.

The design of a poster should emphasize and complement the information that you want to convey. Remember that some of the most successful posters contain no words at all. Let the image do the talking. Don't make the poster too—big as this may create problems for those whom you might wish to display it, since most organisations do not have unlimited display space.

A3 (297mm × 420mm) is the most popular and useful size; A4 (210mm × 297mm) is a little small to make a great deal of impact but may be more acceptable if you want organisations to display the poster for a long time. Ideally, you should produce posters in a variety of sizes to suit varying locations. A one-off poster can be prepared by hand if you have someone artistically inclined, but for any quantity you will need to have access to printing facilities or a good photocopier capable of enlarging and reducing. Use coloured copier paper for effect if you are printing only in black. Colour photocopiers are becoming more widely available but copies are considerably more expensive and may only work out cheaper than printing for very short runs. Another method of reproduction for posters is silk screen, which is a kind of stencil process. Some community arts centres make silk-screen facilities available to groups and will show you how to go about it.

Directories are the most useful publications that a community information service can produce. It may cover the whole of a community, be confined to the interests of a particular client group, or contain information about a certain type of organisation, e.g. social welfare agencies, local government services, etc. A directory plays an important role in community development by informing people about the services that exist and thus encouraging them to take a more active part in community life. It helps newcomers fit into the community and is a tool for those people to whom others turn for help and advice. A directory will usually be based on an information service's database but reproduced in a format that is easy to understand and use.

A directory aimed at the whole of a community and containing a lot of information will need to be produced as a book, rather like a telephone directory. An alternative is to publish it as a supplement to a newspaper, but this carries the danger that it will be discarded with the newspaper and not kept for reference. If you intend to produce just a small number for use by other information centres and agencies who have contact with the public, then a loose-leaf format may be more appropriate, since it allows you to send out updated sheets as information changes.

Directories can be arranged in a number of ways fairly common method is alphabetically by name of organisation under broad subject groups which in turn may be further subdivided. Where the directory covers a number of distinct and separate towns or neighbourhoods, you may want the primary arrangement to be geographical. Other possibilities include one alphabetical arrangement by name of organisation, with a subject index if required or an A-Z by subject. A contents page at the beginning may be necessary to locate sections quickly. Also include at the beginning any information that may be required, urgently, such as emergency services.

Directories are used mainly to locate specific items of information quickly, so if the arrangement is not clear and well signposted, you may need to provide an alphabetical index. Certainly, in a directory aimed at other information services, there will be a need to index by the subject interests of agencies, groups, etc. as well as by their names. If there is more than one entry per page, then each entry should be given a running number to which the index should refer, rather than a page number.

Pleas for up-to-date information are often made by workers in many spheres of activity who do not have the time themselves to search the literature. Community workers, social workers, information and advice workers, doctors and health visitors are just a few of the groups which might benefit from a regular flow of information. Current awareness bulletins are one of the best ways of supplying that information in an easily digestible awareness bulletin is a duplicated listing of items of information which would be of use to a certain group or groups of workers. Where a publication or periodical is available locally, it is helpful to state this at the end of each item using for brevity, if necessary, some sort of code to indicate location, with a key provided at the beginning or end of the bulletin. Each item should be given a distinctive number so that requests for further information, photocopies or loan of material can be identified clearly and simply.

Handbooks often contain directory-type information but mainly the text comprises descriptive information, e.g. about services, rights of individuals or groups, advice on personal matters, courses of action, etc. Handbooks are usually aimed at groups of people who have particular needs—elderly people, people with disabilities, parents of children under five, young people—or they may cover a defined geographical area. You may have to get help with writing the text from people who have knowledge of the subject. The arrangement of a handbook will depend to a certain extent on its subject but a simple method is to use broad headings arranged alphabetically. A contents page and index are essential for locating specific items of information quickly. Use illustrations to break up the text and add interest. Handbooks can be expensive to produce and you will probably need to get help with finance.

Packs are increasingly popular form of making information available, especially to people who perhaps do not have a habit of reading books. They are also useful for community information services that have limited staff resources and where the service offered is mainly of the self-help type.

Packs vary from a simple plastic bag to specially embossed or printed folders. Their chief attraction is that they enable a number of flimsy items on a related theme such as leaflets, information sheets, small booklets, flowcharts, sample forms and letters, booklists and address lists, etc., to be brought together in such a way that the whole is greater than the sum of the parts. Sometimes it is necessary to link items with a specially prepared text. Packs are easily duplicated for distribution to outlying centres and, if well produced, can entice people to browse through them who otherwise would not use a more conventional book form. Some organisations even produce them to give away. Some, disadvantages to packs are that they need to be displayed face outwards for maximum impact; they need to be regularly checked and updated; and without careful and attractive presentation they can so easily appear to be just a rag-bag of assorted ephemera.

Newspapers, local radio and, latterly, cable television can be important vehicles for getting information to the public, in addition to their usual fare of sensational stories. The media will often readily accept offers of free material from outside organisations, provided it is presented to them in the right way and would be of interest to their readers, listeners or viewers. The great advantage in using the media is that your information will reach a much wider audience than it ever would by any other means of dissemination, even if said means is not a very permanent one. Of course, the decision as to how that information is presented to the public will be out of your control.

Press, radio and television are important means of publicizing your community information service, since they offer the potential of reaching many thousands of people from all walks of life. They are also transitory media and so need to be continually fed information about your service. It is no good thinking that an advertisement placed five years ago when your service was set up, is still going to attract users! There are basically three forms that publicity about your service could take on any medium: general features about the service, news items, and advertisements or commercials.

Newspapers are likely to be the most common method of publicizing your service. There are four main types: the national press, local newspapers, 'free' papers paid for by advertising, and community newspapers. The latter are usually non-commercial and serve a fairly defined neighbourhood, often being delivered to every door free of charge. They are a good means of getting your service known, as advertising is cheaper than for their commercial counterparts and may even be free for a service that helps the community.

Community newspapers are likely to be more receptive to feature articles about your service and may even be prepared to let you have a regular spot. Many local newspapers in recent years have been transformed into 'free' papers totally supported by advertising. As a rule, these are delivered free to every door in their catchment area but, since the total cost has to be met by advertising, their rates are usually high. They still carry a certain amount of news in addition to the adverts, but not very many feature articles. They may not be read as thoroughly as newspapers for which a charge is made, since there is a tendency to regard anything free as being of little value. Their chief attraction for your service is their wide distribution, which can be exploited by either placing adverts or getting news directly in the paper or using it as a means of distributing your own handbills or leaflets.

The weekly or daily local newspaper is the one with which most people will be familiar, though it is a dying breed. It contains a mixture of news, features and advertising and, next to the community newspaper, will be the most accessible. Some actually carry a column for community service adverts, which are usually free.

Local newspapers are often receptive to feature articles written either by their own staff or, more often nowadays, by the organisations themselves. Write to the editor, tell him or her about your service and ask if s/he would welcome an article. It helps if you can link the article to something that is newsworthy, e.g. an anniversary, a new service, loss or reduction in grant or increased use, particularly if the increase relates to a growing problem, e.g. debt. If you are contributing the article, then you will need to know how many words are required, whether there is room for an illustration, and the deadline. With this kind of article, it is common practice for newspapers to run it when news is slack. But what sells newspapers more than anything else is news which, in journalistic terms, concerns some happening or event that creates conflict, hardship or danger to the community, or even a scandal; features something unusual; or displays individualism.

As well as newsworthiness, newspapers also look for that magic ingredient: 'human interest'. Telling them what you do every day of the week does not constitute news, however worthy it may be. Unusual requests or happenings do, even if they are not directly related to your service.

It is highly unlikely that a local community information service will need to use the national press to publicize its services, although there may be occasions—when a service has done or is planning something unusual, controversial or spectacular—for which it might be worthwhile to interest the national press, especially if the event has wider significance. You may also attract wider publicity by involving a famous local politician or media personality, or a government minister who may see it as a platform for issuing a policy statement. In these cases you must accept that the attention will be on the personality rather than your service.

For services with a national clientele, the national press may well be an appropriate outlet for their news. The usual approach will be by press release, of the type shown below. In some cases it may be possible to cultivate journalists with a particular interest in community services and make a direct approach.

Magazines, specialist journals and current awareness bulletins are other possible outlets for publicizing a national information service.

The expansion of radio networks in recent years has meant that most major urban areas of the country and much of the rural hinterland is served by at least one and sometimes more local radio stations. Most of these stations are readily accessible to community organisations and services, probably more so than local newspapers, and will usually be pleased to broadcast announcements of events free of charge.

Access to television for local community information services may then become a reality. However, for the moment most national and regional television channels have programmes which give access to community groups. If you feel that your service is making a unique contribution or doing something innovative, you may be able to catch the attention of a producer. In addition to these social action programmes, many of the commercial television stations offer the facility of public service announcements. These enable local voluntary, statutory and community organisations the opportunity to 'advertise' in short slots between programmes throughout the week.

Staffing

An information service that is merely an extension of an already existing service may be able to make use of the same staff, given that they have sufficient spare capacity, are in sympathy with the aims of the new service and, where necessary, have been adequately trained. Avoid loading extra work on to already hard-pressed staff as this can cause resentment and will not help to ensure the success of the service.

Make sure that the administrative and clerical services will be able to cope with any increased demands made by the service. It may be that in order to take on a new function, some aspects of the existing service will have to decline or be dropped altogether. Again, it is important to get staff committed to these changes from the beginning and not to present them as a fait accompli without discussion. If you are starting an information service from scratch, then a decision will have to be made whether it is to be run by full- and/or part-time paid staff or volunteers, or a combination of both. Either way, the first priority will be to obtain a suitable person to organize the service. Such a person will need to have a hand in drawing up job descriptions, selecting staff, recruiting volunteers, arranging training, publicizing the service, setting up the information system and making sure that adequate records are kept. Depending on the type of service, they may also need financial skills. Prepare a job description and a person specification for the post and, if it is to be a paid appointment, set the salary and hours of work.

To find out what salary to offer, check adverts in appropriate periodicals or newspapers for similar posts, approach other information services of a similar type, or contact the umbrella organization, if there is one, for your type of service. Even where the organizer's post is to be a voluntary one, the degree of commitment expected may warrant a small payment or honorarium. Make it quite clear to whom the organizer is to be responsible. The number of staff or volunteers you require will depend on the information service you are planning, the opening hours, and the volume of work expected. Opening hours must take account of the needs of your community and of the interests of your staff. Long opening hours obviously make the service more accessible, but the staffing requirement may be too great for the resources available.

Staff also like to be kept busy—long periods of inactivity can be demoralizing unless there is 'housekeeping' work that can be done in between enquiries. It is best to aim initially for modest opening hours chosen to suit the likely patterns of most usage and the availability of staff or volunteers. You can always expand or adjust in the light of experience and with further staffing. Research into the use of advice services has shown that there is a sort of threshold of opening hours. Once the threshold is passed, the increase in use is proportionately greater than the increase in hours. If your service is aimed at the public, try to get a mixture—day, evening, lunchtime, Saturday—so that as many people as possible have a chance to visit the service.

As well as sufficient staff to cover the hours your service is open, you will also need to make allowances for sickness, holidays, training and unforeseen disasters. So don't rely on just one person: there should always be adequate back-up staff. Most full-time workers in effect only work about 200 days each year, once allowance is made for weekends, holidays and sick leave.

If your information service is part of a larger organization, such as a library service, then salary scales and conditions of service are likely to have been determined already. Most information and advice workers, even in independent centres, are paid on the Administrative, Professional, Technical and Clerical (APT&C) scales used by local authorities. A job evaluation study in the mid-1980s valued generalist advice centre workers' posts on the following APT&C spinal points and salary scales.

Many local authorities are now employing staff—particularly senior staff—on a contract basis, usually for three or five years. It is a method of employment that may lend itself to those information services whose funding is insecure from one year to the next. Since continuity of employment cannot be guaranteed, staff could be appointed on a short-term contract basis, renewable every year when funding is determined. However, a service would need to weigh up the possible disadvantages that might arise from an insecure workforce, such as low morale. If such a service does decide to offer staff permanent employment, it must be aware of the need to make provision for redundancy in the event of a cut in or withdrawal of funding.

Volunteers can be a great asset in running an information service, provided they are of the right calibre and are suitably trained. Indeed, some services, like Citizens' Advice Bureaux, exist substantially on voluntary help. In recruiting volunteers, you will need to draw up a brief description of the type of work you expect them to do and a personnel specification detailing the qualities you are seeking. You may be overwhelmed with enquiries, since information and advice work is generally regarded as being a very worthwhile and satisfying activity because it is varied, interesting and its effects are often immediately recognizable. Not everyone, however, will be suited to this kind of work, so you will need to take care over selection, particularly if confidentiality is required.

Volunteers give their time and skills free of charge but they should be reimbursed for expenses they incur in doing so. There has been a move in recent years for volunteers, whether employed by a voluntary or a statutory agency, to be issued with a contract in the same way as paid workers.

Once you have selected your paid staff and/or volunteers, you will need to provide them and subsequent recruits with access to some form of training, depending on the demands of your service.

At the very least, it is usual for new staff to undergo an induction programme which should aim to familiarize them with all the aspects of the service—from why it exists to where the light switches are, and the broader context in which it operates. Ideally, you should draw up an induction checklist of all the areas that you need to cover with each new member of staff.

If time permits, there is merit in staff spending some time with other information and advice agencies in the area, in order to be aware of the range of services they offer, the type of clientele served and the particular strengths of each organization. Beyond that, you have to decide whether the skills required to operate the service can be obtained by any of the following:

- formal internal courses;
- informal methods, such as 'sitting next to Nellie';
- external local courses;
- external national courses;
- self-tuitional material.
- continuous learning;
- refresher courses.

Formal internal courses: Organizing your own internal training course has a number of advantages. It can be slanted to the particular needs of the service and the acquisition of basic skills can be practised using the materials and equipment that the recruit will have to hand in operating the service. It can also be combined effectively with practical 'on-the-job' training. Such a course will need to combine formal talks with practical exercises and possibly visits to other information and advice agencies.

Usually the presence of 8-10 people is regarded as a minimum for running a formal course. Less than this and you may want to consider using a combination of continuous 'on-the-job' training and external courses, or combining with one or more agencies to provide a joint training scheme. Model internal training programmes are set out in the following publications and may be useful in planning your own scheme. An excellent study on *Education and training for community information and advice work* was submitted by Julia M. Reid as part of her Master's degree at the University of Sheffield Department of Information Studies in 1982. It is not just a theoretical work but contains details of courses that existed at the time, including the reproduction of syllabuses.

Informal training methods: 'Sitting next to Nellie' is perhaps the most time-honoured method of imparting practical skills and is still one of the most effective, provided 'Nellie' isn't also passing on bad habits. As the name implies, it involves the recruit sitting alongside an experienced information worker or adviser in order to learn how the job is done. Nowadays the technique probably has a more nondescript, non-sexist name, such as 'work shadowing'.

External local courses: If formalized training is required and you do not have sufficient new recruits or the resources to warrant running your own course, then look around for any courses already on offer in your area. Some colleges of further education run courses in such subjects as welfare rights, often in conjunction with organizations like Child Poverty Action Group or the Workers Educational Association. Some CVSs or other umbrella groups organize basic training courses or ones on more specialized topics.

External national courses: There is a variety of courses available nationally which provide some training that would be helpful to staff running an information and advice service. These range from academic courses leading to a professional qualification to day courses organized by national information and advice agencies, often specializing in a particular area of work. Space will allow only the briefest of details about the kind of courses available.

Librarianship courses: Most library schools attempt some coverage of community information, if only as part of a more general course, and related skills such as information retrieval. A few library schools feature community information more prominently in both the required and the elective elements of their syllabus.

Staff of an information service are kept up to date on new information and developments, so you will need to devise a system for ensuring this. One way is to organize a regular staff briefing session at a time when the service is not open to its customers. Sessions can be used not only to impart new information but also to discuss recurrent problems, difficult enquiries and newly-discovered sources of information. It may not be possible to get all the staff together at one time, especially if the service is run by part-time staff and volunteers. In these instances you may need to use a bulletin board or regular staff memos/newsletter. In addition to continuous learning, your staff may need to attend refresher courses, particularly in subjects they need to know about but do not use regularly, and in order to develop new techniques or keep up to date in ones already acquired.

2

Changing Information Environment

In the space of only a few years, the unprecedented growth in the research dedicated to technological sectors has resulted in a wide range of innovations leading to the convergence of various techniques, convergence that in turn has become tangible reality. Communication systems have unified, to such an extent that telephone transfers and television pictures no longer circulate on separate channels. Computers and television sets are one and the same thing, telephones are linked to the internet and mobile phones are connected to lap-top computers. These changes also have far-reaching sociological implications, not only in terms of the ways we use the new technologies but also in the ways we have recourse to their services, and for what purpose.

At the same time, the fact that computers can now be interconnected has marked a new step in innovation with the emergence of worldwide communication networks. At the forefront of these is the Internet, a living encyclopedia which makes no distinction between telephone, satellite or television to route the information it contains. Optimum performance of the network will not be achieved, however, until very high performance circuits have become commonplace. That movement is now under way, through the growing integration and interconnection of new information technology with telecommunications resources.

It can be seen in information highways, the synthesis of technological convergence resulting in widespread interactive multimedia offers. This break with the past, one of the major undertakings for the next century, symbolizes a society in which network distributed information and intelligence will be the major forms of wealth. Most governments are persuaded that such is the case, and are already preparing vast schemes with information highways as their priority to enable their societies to take part in a new economy, to enhance the productivity of already existing industries and to create new ones.

With this in mind, economic actors in all sectors of the information and leisure industries including suppliers of telecommunications hardware and infrastructures are already taking up their positions. Groups are being set up for this purpose, launching intersectional alliances which have generally led to high market concentration and internationalization. These upheavals, both technological and economic are radically modifying the ways in which we use communication, both at work and in the home.

New possibilities for training, education, employment and leisure activities hitherto reserved for an elite can now be afforded by all. People communicating now have powers of transmitting and receiving information undreamed of even ten years ago. Combined with geopolitical change, to raises a number of questions about legislation, the gaps existing between nations and within them, the risk of rendering local cultures uniform, and the role of public services when forced to compete with domestic and supra-national private programmes.

The accelerating progress in new information and communication technology is essentially based on three fundamental changes: the digitization of images, sounds and data; digital data compression; and the growing power of electronic components. These innovations have made possible the gradual replacement of analog equipment by digital systems that are clearing the way for greater interactivity between end-users and terminals.

Digital technology will lead to the integration of information transmission networks and reception hardware, and, on the other, it will simultaneously enhance a new relationship with the media and the way in which we consume the information they convey. Basically, this revolution stems from the spectacular progress made in microelectronics, leading to the digitization of images, sound and data. In conventional so-called analog systems, sounds and images were converted into electrical signals so that they could be transmitted on physical support systems such as wires and optic fibres, or in electromagnetic wave form via terrestrial broadcasting networks or by satellite.

Digital compression has solved the difficulty, by reducing the flow of information to decrease the time and therefore the cost of transmission, without modifying the quality and content of the information itself. In radio broadcasting, digital techniques and particularly that of data compression will make it possible to transport, on a single transmission channel, several services, or several television and radio programmes, with several sound tracks in each one of them, as well as a single programme based on asymmetrical loop multi-plexing.

Digital compression also makes more efficient use of the channels available and thus reduces or shares out the cost of transmission. After pervading telephones and computers, digital technology has now tackled the last link in the chain of image and sound broadcasting: use by the public at large. The consequences for television viewers and users of images will be greater than those affecting users of computer or telecommunications technology, since television is a consumer market with a much higher penetration rate than the other sectors of the communication industry.

Development of digitization and its applications is based on the extraordinary breakthroughs in electronic components. Miniaturization of components and memories and the enhancement of their technical process are ongoing processes, making them smaller, faster, more powerful and less expensive. Meteoric changes such as these provide the new information and transmission support media with new powers of communication. The general process of digitization has resulted in the emergence of a new feature: the convergence of telecommunications, computer and audiovisual technologies, which were previously separated by techniques, legislation and modes of distribution.

The new concept has given rise to different definitions and interpretations according to each operator, institution or researcher concerned. Harmonized, common development of convergence is difficult to find, because each state is strongly influenced by its own history and the different levels of development of its telecommunications and audiovisual sectors.

However, the structural transformation of the public sector and new legislation look forward to the development of such convergence. Several angles of approach are possible. Some authors see convergence as comprising three different features or levels: the technical convergence mentioned above, economic convergence and convergence in legislation. Others add the convergence of social customs and expectations. The Organisation for Economic Co-operation and Development (OECD) distinguishes three other types of convergence: technical, functional and corporate.

Technical convergence refers to the use by the communication industry of signal digitization. It is evaluated according to the progress in the digitization process in the three communication sectors. Computer technology is by definition completely digitized. Digitization in telecommunications is an ongoing process which is already highly advanced in terms of both transmission and packet-switching. Finally, the audiovisual industry is making giant leaps in the digital world. Technical convergence, then, refers to the adoption of the general process of digitization.

Functional convergence refers to the diversification and increasingly hybrid nature of the services offered by communication media which hitherto have been distinct. This means radio broadcasting services will be able to transmit signals other than information or entertainment programmes; in addition to the conventional services of dialogue and data transmission, the telephone industry will also be able to transmit entertainment; cable-based distributors on their side will be able to provide telephone services. Functional convergence may thus be summed up as free competition between the radio broadcasting, telecommunications and computer technology sectors, and the disappearance of the traditional boundaries between these three industries.

Corporate convergence refers to the new capacities of the communication companies to diversify their sources of finance. In this way, companies telecasting audiovisual program will be able to make viewers pay for them direct, and will no longer have to limit themselves to indirect revenue such as advertising or state subsidies.

The same principle applies to telecommunications companies, which will now be able to seek other sources of finance than direct fee-paying alone. The distinction in technical terms, therefore, between the various sectors of the communication industry is less self-evident, owing to the fact that information is processed in digital form and that the transmission infrastructure itself is multi-purpose.

Functional convergence and that of the companies involved is thus melting the barriers between the different sectors of activity. While opinions are unanimous with respect to the reality of convergence, particularly in terms of its technological nature, debate is still heated about the lead times that will be needed to provide each home with programmes that are interactive, easy and fast to use. Some believe it will happen tomorrow, others talk of its realization ten or twenty years hence.

New media environments

Computerization of editorial work has had a revolutionary impact on the techniques of journalism, creating new jobs and changing old ones. It has provided publishers with an opportunity to take part in the digital revolution which is now under way, notably by enabling them to provide online newspapers on the Internet.

In the radio market, broadcasters have taken advantage of the new transmission systems to diversify the programme offer and improve listening comfort, the trend now being to provide high-fidelity digital satellite programmes, or even to create a site on the Internet.

In the television sector, data digitization and image compression techniques have led to a vast increase in the programme feed with a qualitative improvement both in pictures and sound. The same technology also provides new possibilities for interactivity that may, on the one hand, revolutionize the way we watch television and, on the other, enable viewers actually to affect what happens in the programmes.

Increasing number of information media has encouraged non-stop growth in the range of programmes on offer, with theme channels, specialized magazines, and local radios of an associative or community type in particular, but has also resulted in fragmented listening and reading behaviour patterns. The consequence of this enlarged, personalized form of consumption is likely to favour the transfer of the programming function from broadcaster to viewer.

'Zapping' and repeat broadcasts via digital programme streams or VCRs mean that users can consume video and audio services on demand, whenever and however they wish. Digital television will enable users to access a wide range of new services, such as pay-per-view TV, the down-loading of video games or software, or channels specializing in sports or tele-shopping.

Based on the North American model, these services are currently developing with increasing speed by making viewers pay for programmes as they consume them, in the same way that they pay for their electricity or telephone services. The requisite decoders are already on the market around the world and are the cause of industrial battles about rival standards. Their regulation is a vital issue in the audiovisual management of digital television, because they are the key to consumer households, the means of monitoring viewers' choices, and that of ultimate control over contact with the customer.

The profusion of networks and audiovisual channels raises the question of what programmes are to be fed to them, since new support media will not sell if attractive, quality programmes are not developed to be shown on them. Content has become a precious, rare and costly commodity, resulting in bitter struggles for exclusive coverage rights and hence control over distribution.

Internationalization, progress in democracy, and freedom of enterprise and expression have led to upheavals in the media landscape everywhere around the world. Clear-cut traditional geographical divisions have given way to a wider range of market diversity and subtler shades of distinction. The conventional divides between a virtually uniform, poor Southern hemisphere and a wealthy, homogeneous Northern hemisphere have narrowed.

New trends are emerging, with certain countries such as Egypt, India and Turkey making inroads in the Dress sector, while others such as Brazil and Mexico are making their mark in the audiovisual field, having learnt how to compete on equal terms with the major industrialized countries. Yet it is still the case that the majority of the developing nations and small industrialized countries have neither the same financial resources nor the critical mass to feed their television channels with programmes. The danger therefore exists that some nations may dominate the programme market, with the concomitant risk of a certain form of cultural standardization.

In reaction to technological breakthroughs and competition from pictures, newspapers are seeking to maintain their market share by increased diversification, with a considerable degree of determination. They are players of increasing importance in the other communication sectors, including the audiovisual field, radio, telematics, publishing, bill-posting and direct marketing, and are gradually spreading their activities to include the multimedia market by offering their services on the internet. Technological developments and digitization have impacted a number of links in presswork, making newspapers more accessible and more convenient for readers who have now also become television viewers, as well as providing newspapers with new means of adapting more easily to competition from pictures. The same technical advances have also enabled the press to give greater emphasis to photographs in relation to text, to graphics over the written word, to colour over black and white.

Computerization of editorial staff has caused a real upheaval in working habits but has also marked a genuine development in presswork. The possibility for journalists everywhere to type their own articles, type copy and enter it directly into a computer system has completely transformed the profession. Keyboard operators previously responsible for inputting copy, and who themselves had replaced traditional typesetters, have already gone in some countries and will disappear in the medium-term elsewhere. Similarly, the manual mounting of pages previously prepared by the editing supervisor and carried out by typesetters and copy preparers is beginning to disappear in some publications, to give way to computer-assisted page make-up. As a result of the automation of the printing sequence, the numbers of staff in newspaper printing shops, from reel hands to controller hands to typographers, graphic artists and photoengravers, have been considerably reduced.

The advantage in micro-computing for journalists is that they do not have to be permanently present at the head office of the newspaper. For several years now, reporters with the major publications around the world have been using lap-top computers to type their text on site at their assignment and front-end them into the production process via any telecommunications network.

The widespread adoption of these techniques and their influence on the gathering, transmission and use of information have had an impact on journalism in general, which no longer entails working for only one of the media, as is still the case in some countries. Journalists now need to be versatile in order to be capable of switching from one branch to another. These new processes, enhanced by digital transmission, have penetrated the market because of the need common to every newspaper to go to press as late as possible in order to print the most up-to-date news and keep manufacturing costs down.

The current trend is towards complete digitization of the whole of the photographic image chain, from film-free cameras to the scanning and production of printing plates, via image processing on work-stations where photographs can be displayed on-screen, to be cropped and retouched before being inserted into the final page make-up. Layout artists can thus make up the whole newspaper direct from computer to printing plate, without having to edit hard copy and film in order to copy the plate itself. Newspaper production is now fully controlled by computer. From web tension to ink feed, from the registration of four-colour prints to the inserting of quires, down to the counting of copies at the delivery unit—all these steps are programmed and executed by computer. Computer technology is equally present throughout the newspaper distribution system. Every day, computers calculate the number of copies to be deposited at each point of sale, suggest optimised routes for carriers, control the printing of addresses and trigger requests for subscription renewals.

Satellite networks

With the emergence of the digital age, the new generation of satellites is likely radically to increase the supply of interactive services accessible to the general public. The digital satellite market is booming. Market share is probably greatest in the countries of southern Europe and in developing countries where the penetration rate for cable TV is low, even non-existent.

Cable networks

Cable TV operators today are fully aware of the new capabilities of satellite retransmission which, through data compression, have boosted the range of programmes on offer and brought new interactive services into being. To meet the competition from satellites, cable TV operators use various transmission resources and data compression to enhance their capacity on coaxial cable networks. They also rely on new optic fibre architectures and on progress in Asymmetrical Digital Subscriber Loop technology (ADSL). This is a digital transmission technique provided by telecommunications operators to broadcast pay-per-view video over their copper wire telephone network, hence the name Video Dial-Tone (VDT). The process makes it possible to transmit up to four television signals at the same time as telephone conversation. In other words, the subscriber can talk on the telephone and watch a video programme transmitted at the same time over the same telephone line.

The advantage of this type of technology is the ability to offer pay-per-view video type services over the telephone network without any major investment, as long as the home of the subscriber and the telephone switchboard are both equipped with transceivers. The change which has had the greatest impact on the current radio broadcasting environment is without doubt the emergence of optic fibre (light modulation) cable as a potential means of transmitting communication signals. Thanks to optic fibre, telephone companies and cable TV operators can provide broad-band video services which would be impossible with conventional metal wiring networks, or, at any rate, only at greater cost and with less efficiency.

Digital terrestrial networks

Digital terrestrial networks are still the main means of telecasting, enabling more than a billion television viewers worldwide to receive their programmes, despite the developments in other telecasting means such as cable or satellite, which offer greater capacity in terms of the number of channels available. Conventional technology has made a comeback through the new possibilities provided by a technology for digital data compression known as MMDS. This process leads to improved picture and sound and above all makes it possible to broadcast four times the number of programmes received through the conventional analog technique, as well as enhancing spectrum management. In concrete terms, television programmes are picked up via a dish antenna which receives a multitude of programmes. A specific MMDS technology transmitter with a range of 5 to 10 kilometres broadcasts the pictures. In surrounding villages or rural areas, a small receiver antenna can distribute the signals to between ten and fifteen households.

Broadcasting each digital microwave stream, however, will require the installation of a special network of transmitters and relay links. The investment may be competitive compared with the cost of a satellite repeater, which is generally rented at around $600,000 per year. The technique is currently developing at high speed in regions such as Africa, the Middle East and the Russian Federation, as well as Central and Eastern Europe, where homes are too widely scattered for the installation of cable networks to be economically viable. There are a number of digital terrestrial broadcasting projects currently under way.

The British Government was the first to propose the introduction of digital terrestrial broadcasting in the United Kingdom as early as 1998. Some thirty digital terrestrial channels will be launched prior to this date. Without having either their sets or their aerials altered, more than 70 per cent of British homes will receive these programmes with the aid of a special decoder. The United States of America, however, was the first to develop a concept of a digital terrestrial broadcasting system, initially designed for high-definition television (HDTV). The Federal Communication Commission (FCC) sees the advent of digital terrestrial broadcasting as a means of enhancing the efficiency of spectrum management.

Mobile networks

Mobile systems form the terminal link in a communication network, and provide the multi-purpose and integrational functionalities required by the recent trends in technological convergence. A mobile telephone equipped with a modem and connected to a portable computer can thus be converted into a genuine mobile office, since it can receive and send faxes and files, and access e-mail services from anywhere around the world. It is in the cellular telephone market, however, that growth in mobile communications has been greatest. In the developed countries, which are well equipped with stationary communication systems, the cellular telephone matches the diversity of professional and personal uses and requirements.

In the developing countries, it represents an advantageous solution, capable of making up for the shortcomings of the conventional telecommunications infrastructure, particularly in underprivileged areas or those with a low population density. The mobile communications market has one of the highest expansion ratios in the telecommunications sector, with an annual growth rate close to 20 per cent. Mobile phones are thus switching from being upmarket to mass market. That development is likely to be to the detriment of wire-frame networks, which may be abandoned by a vast group of end-users in favour of a telephone number that will follow them wherever they go. The cellular phone is rapidly becoming something of a panacea above all as a result of the progress in worldwide telecommunications projects.

Internet

Internet is a worldwide co-operative society composed of a multitude of dispersed networks, in which individuals and social groups develop independently of any specific place, culture or country. It is managed by a community of users, and finances its operating costs via its members, who pay connection fees to hubs entrusted with routing the data exchange, or to local providers who connect up to the hubs. It is a tangible illustration of the way in which the general communication system has changed, and embodies current convergence by offering an ever-increasing number of services, with audio and video functions integrated with most applications.

Internet has become a tool for use by the general public and by private users, whereas it was initially designed to provide a communication medium for military and, subsequently, academic use. The economic issues at stake are such that the battle has already started between two rival digital transmission standards. On the one side there is the American technology known as Multiple Access by Code Distribution (AMRC or CDMA), and on the other the European standard called the Global Standard for Mobile Communications (GSM).

Mobile communications seem destined to a fate similar to that of video cassettes for VCRs: in the coming years, one of the competitors will have to go. That is why each type of technology, supported by its countries and companies, is redoubling its efforts to prove its superiority. The battle is being fought not only in the European and North American theatres, but elsewhere around the world where the markets have yet to be exploited. The winner will gain equipment supply contracts worth several billion dollars, and thus reign single-handed over the mobile telephone market.

According to internet experts, if the trend continues, every facet of human knowledge will be on the network in less than ten years from now. In 1936, the Internet had some 40 million internauts. With a current growth rate of 12 per cent per month, it is estimated that by the year 2000 the figure will rise to 100 million people. With its worldwide expansion and the increase in throughput rates, the Internet is currently opening to other sectors such as the worlds of industry, electronic shopping, the various media, and scientific and academic information.

Today, each of the major media is setting up sites on the Web in an attempt to compete with the other conventional media in the fields of news, entertainment and leisure activities. Written press and television sites generally offer articles and photographs, and even audio or video recordings, while in recent months radio stations have started using the Web to broadcast programmes around the world, either live or recorded. Finally, the Internet is a serious threat for fax machines and even telephones. The use of e-mail is expanding at an infinitely faster rate than fax machines in their day.

The Internet offers infinite potential for training and education. It already forms one of the greatest sources of information and documentation accessible anywhere around the planet. Several thousand scientific and technical publications can be consulted, generally free of charge or for a modest sum. The Internet enables university staff and researchers in developing countries lacking libraries or documentation centres to overcome their scientific and cultural isolation and remain in close contact with the international scientific community. It will completely transform their conditions of work by enabling them to access the vast resources of the leading research centres and universities in the industrialized countries.

Information highways

Information highways are high-speed global networks capable of routing to subscribers at high speed a series of new interactive services, such as distance learning, data bank querying, teleshopping, telemedicine, pay-per-view television, picture phoning, etc. These would seem to be the basis for a true technological, economic and cultural revolution, destined to eliminate all geographical, temporal and cultural frontiers. In industrial circles they are compared to the grand civil engineering projects of the nineteenth century, such as the construction of cross-continental railways, or the first motorways. They will enable users to upload or download information to and from any point on the network, and to obtain information tailored to their requirements. At the same time, information users can become information suppliers.

Information highways are not a single physical network but a series of local, regional, national and international infrastructures linked to form a worldwide information highway. Like any other grand technological project, they have aroused heated debate which boils down to a confrontation between those who are for and those who are against their development. Some merely see them as yet another technique which will render the reality of social relationships even more virtual, accentuating individualism within society and further widening the gaps in development not only between nations but also within them. Others, on the contrary, consider that if the information highways do indeed come about, they will lead to far-reaching changes, particularly in the sectors of creative art, education, adult training, health and culture changes, they add, which are likely to create new demands for other services. The giant task of constructing the information highways and the estimated cost of setting them up are a golden opportunity for computer manufacturers, software publishers, consumer electronics manufacturers, telecommunications network operators and other groups of information holders.

The industrial task is that of making information highways and their applications available to a public about whose future behaviour nothing is known. No one can say with any certainty whether the public are going to want new interactive services. But for the manufacturers, the potential market is enormous, and justifies taking the risk. With this outlook in mind, numerous alliances between firms are being set up to control the global information industry. Over and above the commercial and industrial mechanisms which for the time being seem to be the driving force behind the construction of the information highways, the cultural and scientific issues must not be neglected. The new infrastructures are not just technological vectors, mere solutions put forward by market forces. They also represent, according to certain official policy speeches, a new facility to which users around the world may have at least minimum access, on equal terms and enjoying equal quality, no matter what their geographical location. There is a major risk, however, that access may become the privilege of high-yield markets, particularly where new value-added services are concerned, which therefore raises the problem of the predominance of private interests in the development and organization of the information highways.

The issue, therefore, resides as much in the technological capacity to create an information society as in the ability to promote the conditions for harmonious social, economic and cultural development on an international scale and thereby ensure access for the greatest possible number. Access to the networks presupposes a reliable universal service at an affordable price, meeting the fundamental needs of individuals for education, science and culture. This implies that users, whatever their origin, must be able to acquire the basic 'digital skills' and have sufficiently user-friendly interfaces to benefit from them. It is equally essential that the pluralism of opinions and ideas be guaranteed, and that software which is not necessarily of commercial value be developed.

It is also necessary that the plurality of cultural goods on offer and participation by all linguistic and regional viewpoints be fostered, in order to avoid uniformity and standardization of network content. Finally, in a digital universe which is already deploying its networks and drawing its new frontiers, there is a strong risk that the differences in the levels of development not only between nations but within them may simply widen. This risk is particularly significant in developing countries, which will have to implement clear-cut, audacious strategies to enable users to take advantage of the information highways. The temptation to seek to control access to them, on the grounds that some programmes do not correspond to either religious or political national standards or values, could result in highly prejudicial delays in developing the new communications infrastructures. The free flow of information is an essential prerequisite, not only for the exercise of democratic rights but also for social and economic progress.

The difficulty lies in ensuring that the greatest number of people have access to the highways, and for the same reason, in removing every obstacle or barrier of any kind that might impede or hinder the advance of the highways within nations and between them; the challenge, on the other hand, lies in promoting the diversity of programmes both in their content and in their origin, such that each and every community or sector of society is able to express itself and thereby ensure the survival of its culture, language and traditions, without being systematically tied down by economic considerations linked to market laws. In this connection, the concept of public service urgently needs to be redefined to adapt it to the realities of the information highways.

Economic change

The move towards the information society is characterized by the general dematerialization of the market-place, a feature which has affected every economic sector and has resulted in new modes of economic exchange and corporate organization. It has freed the economy of the conventional constraints of distance and the scarcity of resources.

Digital technology and data compression have produced means of creating information that can be multiplied to infinity, making the information economy one of abundance and profusion. Essential wealth no longer resides in the physical substrate on and with which information is conveyed, but in the growing production of paperless goods and in the development of know-how, which has itself become a strategic resource. On the global information technology market, the value of software and services caught up with that of hardware as early as 1991 and exceeded it in 1992, with sales of almost $200 billion out of a total market worth $380 billion. The real added value is no longer held by computer constructors such as IBM or Compaq, but by the manufacturers of microprocessors and operating systems.

Up to the present date, the computer industry has always been dominated by Intel, which supplies 80 per cent of all the microprocessors used around the world, and by Microsoft, which holds an identical market share in terms of operating systems (Windows 95, Windows NT, MS-DOS), hence the nickname of 'Wintel' often given to personal computers (PCs) today. The operating systems of the one and the microprocessors of the other form the core of more than 80 per cent of the PCs sold around the world, and the two companies lie at the heart of the computer revolution.

Microsoft, the creator of the MS-DOS operating system, is worth more on the stock market today than the American giant IBM. It is astonishingly powerful and financially profitable, with sales of approximately $4.6 billion and a net profit margin in the order of 25 per cent. It also has a major advantage: its domination of the program market for microcomputers—tools which are still an essential prerequisite for access to the Web. Since its launch in August 1995, the firm's latest generation of operating systems for general public microcomputers, Windows 95, has sold 25 million copies.

Microsoft is the fourth-ranking publisher of CD-ROMs worldwide and is now launching projects for broad-band operating systems, as well as the development of a programme navigation and guide system for interactive television. Intel, for its part, has become the driving force for growth and profit in the world of information technology. The enterprise, with net sales for 1995 skimming $20 billion, in 1996 announced a leap of 41 per cent in profits. Its turnover has increased every year by more than 30 per cent to reach $20.8 billion in 1996, with a net profit margin of 20 per cent. Financial analysts estimate that Intel will be soon the most profitable company on the planet, ahead of traditional industries. The qualitative level of the human resources in a country and the capacity of its citizens to use new technology and thus make optimum use of their know-how have become vital factors in competitiveness. The correlation between know-how and economic growth is henceforth an established fact.

Development strategies around the world now invest in knowledge, education and training, as the new keys to success for modern economies. At the heart of this movement lies the exponential development of software systems and services. Real added value is no longer contained in technology or production, but in the ways we use them both. This tendency is particularly noticeable when the situation of businesses in the communication sector, whose activities are exclusively paperless, is compared with that of companies producing hardware.

In audiovisual environment, the most immediate problem perhaps is competition from new forms of image distribution, linked to the development of digital television. The latter has introduced direct pay-per-view systems, thus creating an upheaval in the freedom of television enjoyed up to the present time by commercial advertising. The television market worldwide seems to be based on hybrid forms of coexistence and financing combining the various forms of commercial advertising and direct payment systems. Another feature is the ongoing reconciliation between the cinema and television industries as well as the increasingly international nature of programmes.

Microcomputer technology has become a market in which volumes and economy of scale have become essential in order to compensate for decreasing prices and narrowing profit margins. To be profitable today in the microcomputer sector, a company has to sell at least 1 million machines per year. On top of this, ongoing technological changes, never-ending price wars to sell machines that become obsolete increasingly rapidly, and decreasing profit margins have made the microcomputer market vulnerable, and a reshuffle of the players and their cards is likely.

The weakest manufacturers are already winding up their ventures in computer technology. At the same time, other manufacturers are positioning themselves and taking the initiative in innovation, by creating new architectures capable of breathing new life into the multipurpose microcomputer of the future, combining computer and television technologies. The issue has more to do with preparing the machine of tomorrow, a user-friendly hybrid resulting from the convergence between television sets, computers and games consoles. All the major manufacturers have realized the scale of this development and are preparing for a radical change in their end market.

Microsoft is preoccupied with network navigation-aid software, given the success of firms such as Nets-ape Communications and Sun Microsystem. The first of these two companies has become sector leader with a market share of almost 74 per cent gained with its program Navigator, a software system that has introduced new interfaces such as guidance and navigation instruments for users to find their way through the jungle of addresses on the Internet. To counter the aims of Microsoft, the firm is striving to maintain its position and title by launching a new version of its Navigator program, that provides users with much wider possibilities for sound and video applications. The firm has also set up a subsidiary whose objective is to develop another version of Navigator to equip televisions as well as cellular telephones or games consoles.

The telecommunications industry entails both the production of hardware and infrastructures and the supply of services. It forms the basic infrastructure for any modem economy, as well as being an important link in all international exchange of goods and services. Over the course of the last decade, the telecommunications sector has been shaken by lightning technological changes and competition from powerful networks as a result of the convergence of computer technology, software publishing and the media.

These developments have meant that the telecommunications industry has moved away from its conventional role of a public service providing telephone facilities alone, to become a branch of business generating new services and products considered to be key factors in international competitiveness and productivity.

Like all new technology, telecommuting also is the subject of heated debate. Its proponents put forward a whole series of items in its favour: savings in travel costs and time, the tailoring of work to personal rhythms, reconciliation between business and the rural environment.

Its critics, on the other hand, feel that it does not guarantee employees' social benefits, that it entails a risk of confusion between one's job and one's private life, and that employees have to make themselves more readily available, without any real recompense. They also feel that telecommuting eliminates not only manual work, but even certain professional jobs, those that can be replaced by expert systems or intelligent machines.

Globalization of economic activities has resulted in enhanced concentration in the communication sector, strong growth in the world market for new information technology and an acceleration in the development of electronic commerce. High media concentration is increasingly part of the overall process of globalization, involving cross-border investments aimed at acquiring share-holdings in companies in foreign countries. Globalization thus ensures return on initial capital outlay and increases market share.

The information technology market, including software, hardware and other communication products, currently has the fastest growth rate in the world. According to the statistics of the World Trade Organization (WTO), the market has expanded each year since 1990 by approximately 15 per cent, when the average growth rate for world trade in the same period was 8 per cent. The rate of expansion is even more impressive given that prices are rapidly falling, particularly in the program sector and that of all the software tools serving the exponential growth of the Web. The emergence of world networks has provided a genuine infrastructure for international trade. This has oriented the development of the industrialized countries towards a global information economy, based on the delocalization of companies and free trade.

3

Virtual Reality in Information Technology

Physical and perceptual are indeed different sides of the same coin. We cannot separate them and are erroneous in trying. We cannot comprehend our physical environment without perceiving it. Therefore what affects one will affect the other. Our perceptions will determine the reality we can identify in the physical world. If those perceptions change, then so will our physical world and vice versa. To others the physical world may well hot have changed, because their perceptions have not changed. None us can identify a total reality because each of us has differing interpretations of it.

In organizations we attempt to do just this by implying a common reality. There is a two-way communication process between the physical and the perceptual; one which is inexorably linked and irrefutable. More important for our purposes, there is also a physical and perceptual aspect. The classroom itself, the organization of pupils in rows and the teacher at the front, the textbooks, the blackboard, the curriculum taught along with teaching methodology all form the structure. These then are the physical aspects. They are the most obvious factors confronting the members of this particular organization, and as such they are the most controllable. However, this classroom, like any organization, would not have meaning if it were not for its members and perhaps to a lesser extent third parties, perceiving it to have such meaning. It is no more than a room with a group of people in it of which one happens to be an adult and the rest children of about a certain age. The adult may also possess more useful knowledge than the others and spend all her time transmitting it to them. They all have books, pens, paper and so on which they use from time to time. This is the physical world as it appears to any observer, but it is meaningless and lacks purpose to those who do not understand the concept of classroom. Something is obviously missing.

It is the perceptual agreement of all involved parties, through socialisation processes, that this is a classroom. It is dependent upon everyone knowing the *raison d'etre* of the group, knowing rules, the culture and the norms and being able to place themselves cognitively, temporally and spatially into the group. It therefore involves not only knowing what your fellows are doing and reacting to them, but also the interpretation of your physical environment and the consequential development of perceptual patterns/maps for action in that environment.

These are the perceptual aspects of the classroom. They are the factors which give our organization depth and meaning—its reality. But because the physical aspects of the classroom can be translated only through the perceptions of the teacher and her pupils, it is likely that each is subtly different. The extreme would be between the teacher and the rest. Standing at the front with a completely different role and so exposed to scrutiny, her interpretation of the classroom is not the same as the greater anonymity of a pupil sitting in the back row. For one thing she would continually be confronted by a sea of faces looking and listening to her; whereas the back row pupil may see a mass of necks and one person standing at the front. These two perceptions highlight different roles and hence different necessities for action. In turn these will affect the organization of our classroom because each person's differing perceptions are influencing the realities of that organization in different ways. Take any one person away and the organization will be slightly different. If physical and perceptual organization are so inexorably linked, at what point are we able to identify their distinction? Can we indeed draw a line between them? This is one of the major difficulties, the two cannot be separated, they are meaningless on their own.

The world may exist whether we do or not, but physical reality is made real to us only through our perceptions, and these are only meaningful (objective) for us if they are of something physically real. The two are interdependent and cannot be separated. There is rather a molding of one into the other where the boundary between them is blurred. Physical resource may be organized in a certain way, for example into departments, but the logic we attached to that in order to stimulate action is founded in our perceptions. It is difficult for any existing model of organization to truly reflect this state. Writers have so far failed to capture the real nature of the firm in our theoretical frameworks.

Structural/sociological theorists have also attempted to grasp perceptual and physical sides to their organization models. The most notable of earlier writers was Parsons in his construct of a social system comprising a network of interlocking subsystems such as personality and culture. It was left to the systems theorists to develop his work further. Parsons was concerned with the major system—society—first and foremost and only looked at subsystems as a means to understand that, of which organizations were a part; systems theorists, however, were primarily interested in organizations. In one form or another they envisaged our business enterprises comprising a hierarchy of systems which in their turn comprised a mix of perceptual and physical, such as tasks or technology.

Kast and Rosenzweig identified a psychosocial system within an organization. This system is purely abstract and has no physical attributes. It is perhaps the nearest thing we have to a true perceptual organization. The psychosocial system is defined as the culture of the organization and its norms, and in particular the ability of the organization's employees to 'place' themselves within its context. In many respects, however, it can be all things to all persons, a sort of theoretical dustbin in which to dump abstract things. This imposes consequential problems upon the workings of perceptual organization.

The psychosocial subsystem exists in name only, the terms and concepts within are not given their own form. They are merely expressions to overcome certain nasty things in organization which cannot be easily ignored or explained away. What we in fact have is not true perceptual organization but a sham of it, not really reflecting the realities of the relationship between it and physical organization. This is the greatest failing of the systems model of organization. The nature of its approach, through the study of interaction between parts, demands that to be successful, and for the model to work properly, all the parts must be identified. The absence of an autonomous but interdependent perceptual organization denies the model its validity. As such it fails to give us a complete picture of organization. In particular the failure to identify a dynamic perceptual factor gives us an ability to understand only consequences and not accompanying causes. This is simply because to know how something has come about one must be able to understand the complete picture, whereas to analyse the effects of action alone, as in the systems model, one needs only observation and a partial framework in which to place it. To a great extent the development of a more appropriate perceptual organization would go a long way to answering criticism from Silverman and his fellow social action theorists They believe that functionalist models emphasize consequence rather than cause in social phenomena. In particular, when conducting an assessment of the impact of something like information technology, it is not enough merely to observe consequences of such phenomena; one has to understand the root causes. To do that it is not sufficient to conduct this analysis in terms of the information technology alone since within the organizational context nothing can be considered in isolation. This includes not only the linkages of the many parts of the physical organization, which many models already encourage us to look at, but also the linkages into perceptual organization.

Abbe Mowshowitz examined the social impact of office automation. Much of it was a hard analysis of computer implementation and its effect upon office design. But contained within a few lines towards the end he introduces the concept of virtual organization by highlighting the distinction between logical and physical location within computer technology. There is nothing new in this, but more interestingly he goes on to propose that a social organization may indeed possess the same logic.

We could understand Mowshowitz's logical location as a rough equivalent to our perceptual location, although it is recognized that there are certain differences. The basis of his idea is well acknowledged in the computer fraternity: that is, an interpretation of the data in physical terms, identifying its whereabouts in the computer, does not reveal anything about its informative value. In those terms alone it is just a mass of nonsensical electronic signals. But the way the signals are stored can have meaning if interpreted through another medium, such as a program. The signals cannot be seen in the physical sense, their location in relation to one another may be completely random; there are, however, logical links established through a program which creates meaning. This meaning forms a sense, unseen but logical, and every bit as real as any physical observation.

An impressionist painting can provide a good example of how perceptual form can achieve greater logic than physical form. Close to, the painting has no real sense: its brush strokes are seemingly random. Only by standing back can one appreciate the painting for what it is. This is because the logic of the painting can be perceived only in a certain form. In this sense the logical location of the brush strokes is more important than the physical location. For his example Mowshowitz used a business organization. Because a computer and its control mechanisms are a form of organization he saw a firm as possessing the same logical characteristics.

Mowshowitz, did not pursue this as a descriptive model of organization. He believed that such an analogy was useful in understanding the impact of information technology on organizations. If computer networking is employed then its effects could be minimized by managing on the basis of virtual organization. To him there was often a contradiction and conflict between the needs of the firm as a whole and the needs of its computer organization. He found, as many have, that computer installations tended to break down the predominately physically-orientated control mechanisms. Organize from a management perspective and the computer would lose out; organize from a computer perspective and the management would lose out.

What he was seeking, therefore, was a form of prescriptive methodology to enable management to manage but at the same time to allow the computer to realize its full potential. He envisaged the solution in managers' better understanding of their environment, and thus encouraged the elements which enabled them to maintain their control but at the same time stimulated the necessary structures for computer organization. This is possible because implicit in his hypothesis is the division of a business organization into two fundamental dimensions, the virtual and the physical. The former acts as a sort of perceptive sponge, soaking up the subversive intrusion of information technology and thus protecting the physical structures of organization from its destabilizing effects. The latter—the physical—is the firm as the traditionalist would understand it to be, the functional aspects and its general resource profile.

Mowshowitz did not explore the concept much further, and although he called it a model it was still incomplete. He was interested only in his proposition as a means to analyse the evolution of office automation and its social implications for the work-force. He did not consider his hypothesis a model of organization and therefore did not pursue the much more interesting aspect of his concept—an organization as a dichotomy between two realities, each determined in importance by internal and external forces and existing in continuous competition with the other but in equifinality. Within the boundaries of this model there are five relevant dimensions:

— Organizational arena.

— Elements of organization.

— Enabling mechanisms.

— Organizational states.

— Organization's environment.

Organizational arena is perhaps the most abstract of the five dimensions and represents the physical aspects of the organization along with its perceptual aspects. This arena, though, is more than just a framework for these two aspects. It is also a dynamic mechanism which allows for their continual interaction and adjustment. From a systems viewpoint it is basically one system with two subsystems, where all things in the organization have either physical or perceptual characteristics. As such it is also the most fundamental of all our five dimensions since all aspects must be embraced by it.

Organizational elements comprises three subsystems which we have already met: i) information network; ii) structure; iii) political process. These are the major building blocks of any organization, constituting the aspects which are immediately apparent in any examination. Together they form the framework in which we carry out our working lives. They form the departments in which we work, the communication systems that are established between each of us, and the mechanisms we have developed to help ourselves act and succeed within the organizational arena. Such aspects can be located physically or perceptually depending upon their characteristics. This then is the link between this particular dimension and the previous one. An organization, or indeed any social entity, is a living entity, responsive and continually changing. Although increasingly discredited, that school of theorists which regards organizations as organisms did at least capture the essence of their form. To create a framework of organization and to place it in an arena is not sufficient to understand it. The parts must be wound up, as it were, like a clockwork toy, and given life. It is only in their dynamic state that we can appreciate what it is they are supposed to be doing. Similarly, only when a clockwork toy is moving can we appreciate its full potential. That is why models which attempt to represent an essentially dynamic entity, such as an organization, in a static way are bound to fail because they do not relate meaningfully to the major operating force—movement. Unfortunately, organization theory is replete with such models.

The enabling mechanisms of organization are of two types, which give it those essential dynamic characteristics: the technological process and the decision process. They involve particularly the human element of organization, and it is only through human activity and perception that a firm can achieve form.

The technological process, combining all aspects of human knowledge and skill with the firm's physical and perceptual resource, is the essence of human activity, especially in a formalized collective such as an organization. It allows a firm or individual to exist and survive within its particular environment. It is, therefore, an essential part of any living organization.

The decision process links human perception to action. People must make decisions in order to act. For the organization this is particularly important since the collective decision process enables it to respond to changes in its environment. As such, both are agents of change. Any living mechanism must adapt as its environment and own internal logic demands. A firm may not truly be an organism since it also represents relationships, both perceptual and physical, far more complex than any single organism can simulate. Nevertheless there is a form of life within any organization which cannot be denied and is thus supportive, in part at least, of the organismic metaphor. For all living creatures, change control is important, and therefore no less so for any organization.

Organizational states are must for organisations. There are three concepts—change, balance and equilibrium—to be considered. Each is important for understanding an organization because depending upon what state a firm happens to be in at a specific time will be its characteristics. A firm is not static but dynamic, even when it is not experiencing change. Thus to place that within an appropriate theoretical framework one has to know the net effect of all those dynamic forces, hence the three organizational states.

Organization's environment is the total area external to an organization which has an influence upon it in some way. This, of course, comprises its market, but it also comprises the organization's particular industry if it happens to be a business organization. Beyond these there are not only the political and social processes but also their customs, norms and established procedures. The externalities which their employees or members bring into the organization can form part of its environment because they are, by definition, external influences which can be brought to bear upon any firm. It should not be forgotten that an organization's environment can be both physical and perceptual: it is anything outside its accepted internal boundary which can affect it.

Every organizational environment is different. There may be many similarities, especially in organizations in the same industry or market, but there are also spheres of influence which differ in the same way that firms differ in their people content.

For example, two banking organizations may operate in similar areas and are thus affected by the same environmental mechanisms, but they will each have interests in other areas which will in their turn have different influences. Their employees, for example, are different and thus have different interests. One manager may know the prime minister personally which will affect the organization. The other may be a keen golfer and always absent, thus presenting his firm with a different environmental effect. It is, therefore, difficult to generalize about any organization's environment and maintain credibility. Much depends upon the level, and intention, of the analysis. Governments and their economists have quite often gone wrong because they have either generalized too much and lost meaning or were too specific. For the purposes of this model, the environment is an exogenous influence; therefore in the setting of the framework, at least, it can be generalized. That is not to say that we assume that all firms possess the same environmental influences. It is, however, important that we include such influences, albeit in a general sense, because they can shape the internal forces of the organization. A law limiting the number of public houses that a brewery may own is just such an example of this. Everything that we experience whilst working within them must come under one or more of those headings—there is nothing else.

The environment is as much a part of an organization as are its elements because the organization can be shaped by its forces. Those forces can be physical such as location, transport or government laws, or they can be perceptual such as societal norms. Always dominant in the relationship between these dimensions is the split into their physical and perceptual sides. How that forms will dictate very much how they will operate as subunits and as a total unit. The first two dimensions promote, as it were, the conditions for this to occur. The enabling dimension allows for a link between the two sides, whilst the last two are the framework affected by it. To understand this better we must therefore examine an organization not only in terms of these five dimensions, but more importantly in terms of the split between the physical and perceptual aspects. Every organization, large or small, no matter what type, either has a dichotomy in its form or possesses a potential for it. In general, the larger the company the more prevalent this dichotomy is likely to be. This does not mean that small businesses do not have perceptual aspects, but dichotomy refers perhaps to a more formal relationship found in larger organizations.

Thus the strength of either the physical or perceptual aspects is such that they can be viewed as entities in their own right. The perceptual force available from small businesses is unlikely to be powerful enough to be of any consequence. Therefore when we speak of a dichotomy we are referring to something more than a collection of things physical and perceptual. Of greater importance are the relationships within both these aspects which make them cohesive units. In this way Mowshowitz used the term virtual in order to avoid confusion with the simply perceptual, and to demonstrate it as being something logical and relational rather than merely cognitive.

Virtual organization is much more than some perceptual world attached to the structures of a business firm, and indeed it is considerably more than even Mowshowitz suggested as a basis for technological and structural integration, although it does perhaps lend itself in part to either hypothesis. Virtuality is indeed organization in its own right, competing with its physical counterpart for resources as well as—and perhaps more fundamentally than—the perceptual domination of the actors within their parameters. The particular formation of a virtual organization can affect how actors perceive their environment and thus their allocation of resources to it. For example, organizational culture, an element of virtuality, could affect the way the employees perceive their market and thus how they allocate resources to it. A firm may pride itself on being in the forefront of innovative production, and market itself as such.

Virtual organization cannot exist independently, there must be interdependence with the physical organization. In the final analysis, like every other part of the organization, its meaning depends upon the perception of its members and third parties who are themselves as much a part of the physical world. Sociological phenomena such as culture or norms have not been rejected. These are aspects of any society or organization. They are, however, viewed from a different perspective—that of virtual organization. The traditionalist, functionalist interpretation of such concepts is tied into the physical framework.

We need to establish an homeostatic mechanism whereby virtual organization can achieve a limited existence and thus interdependence with its physical counterpart. For the moment if we can accept that such a mechanism can exist within virtuality, then it should be possible to demonstrate its importance. Different models do not create different organizations, the reality is the same whatever model we use, only our perception of that will be different. A model including virtual reality organization, however, gives us greater analytical flexibility because perceptions are no longer constrained by the physical dimension but form a competing logic within the organization. This has particular significance when examining change. Self-regulation and limited independence are, therefore, important for the physical and virtual organization, particularly so if virtuality is to be differentiated from the psychosocial subsystem. This is because the psychosocial subsystem is construed a subsystem of physical organization, its regulation and survival are dependent upon it and as such no more than a perceptual extension of it. Therefore, to have virtuality mimic such characteristics would be to condemn it.

To stress again, virtual organization is a separate system which nevertheless interacts with the physical system within a commonly defined environment. There are two general implications which arise from this approach.

Firstly, the physical and environmental aspects of the organization have to be redefined. This is caused by virtuality encroaching upon the traditionalist framework. Virtuality creates links with 'out there' beyond any contact with the physical organization and thus affects the established concept of organizational boundary. And similarly, the now separated physical organization has its own set of relationships which are not accessed by its matching virtual system. As such the environment can no longer be defined solely in terms of economics or geography, its boundary is now set by the degree of physicalness and virtuality within the organization and the nature of the balance existing between them.

Secondly, in presenting this model an otherwise physical concept, homeostasis, has been linked to an abstract form virtuality. In theory there is nothing which should prevent this from being done. But the mechanisms for homeostasis are generally translatable into a physical form such as one would find in a biological organism or social group.

However, virtuality must possess some enabling mechanism which will allow homeostasis to be achieved. Such a mechanism is found in both the technological and the decision-making processes which allow virtual organization to respond to change and maintain a steady state. This is not done consciously, of course, since it is only people who can think and act with meaning, not systems.

Virtual organization comprises subsystems and elements. What these elements are depends upon the individual characteristics of the organization. But there are some general pointers which have relevance in all forms of business. These would include concepts such as power, communications, knowledge, information, and self-perception. It should be stressed that these are not separated from the elements of organization previously described. They form part of the virtual organization, but they can also be part of an organizational element.

Thus the first of these, power, for example, is part of the virtual organization but it is also part of the political process. Power is an important element because simply defined it is 'the capacity to produce intended effects', or 'the ability to influence the behaviour of others in accordance with one's own ends'. Individuals or groups have goals and objectives, the achievement of which is in part dependent upon their power. The more they have the better able they are to gain their ends and thus influence the organization. Power is a perceptual mechanism in that it is based upon the perception of others. A powerful woman is only powerful because others are dependent upon her and thus perceive her to be so. Through this perceptual framework interaction evolves which extends beyond the initial parameters set by the original actors, developing a historical continuum by which others respond and initiate their own action, thus adding to the framework.

Communications provide the means to integrate individuals into a perceptual network. As a collective through communication, albeit fractured and divisive at times, people can maintain a higher level of cognitive activity because they are more sensitive to the 'Wider environmental boundaries than they would otherwise have been. This is important for virtuality since such an ability provides a perceptual cement giving the system a uniqueness within its own environment.

As most fundamental of all the generalities, knowledge and information represent our humanity and thus the organization itself, for what is organization other than a collection of resources transformed in some way by our knowledge and information. Knowledge and information, therefore, provide the framework for virtuality, attaching to it characteristics which will be identified solely with that particular organization. The perception of oneself is another generality which needs to be included in virtuality. It allows for individuals to have perceptions about themselves and their position relative to the rest of the organization, which in many cases may not be as the majority see them. This is not critical since people act upon their own perceptions and therefore contribute further to the illusion of themselves.

As for virtuality the importance is probably quite apparent. Employees will be interacting not in accordance with how they really are, but in accordance with how they think they are—the difference is perceptual. The profile of this selection should indicate the nature, at least, of the characteristics of virtuality. However, the concept is difficult to grasp completely. Virtuality is not like a building or the people in it, which is the sort of idea we normally conjure up when thinking of organizations. On the other hand, its effects are just as real. The result is an abstraction which can determine physical aspects of organization and so affect its health and viability. This is possible because perceptual processes can [illegible] do live beyond their moment of conception. Once [illegible], through communication they become part of a larger resource which is tapped by others, and thus easily utilized. As such, a continuum exists independently, in one sense, from physical organization. It is this which is the basis of virtuality.

Probably, virtuality is not applicable to all organizations. It is likely that there is a certain critical size at which an organization can sustain virtuality. Before that point organizations may well operate at a low level of perceptual interaction. After that point, like a newly-created sun, virtuality becomes self-regulatory and thus able to maintain itself. The critical size of organization may vary from industry to industry, dependent upon many factors, but it is suspected that throughout organizations generally their virtuality point has been considerably lowered by the introduction of information technology.

What could have been achieved in this respect by a much larger organization in the past, in terms of information generated to create virtuality point, is being easily achieved by smaller organizations with the use of information technology. It would seem that virtuality is good for an organization. Given the right blend of characteristics, virtuality can stimulate a continued growth. This should be possible because the information and so on generated through the virtual organization would increase by a type of multiplier effect, which in turn would have a knock-on effect upon the firm's physical resource. There are, however, certain conditions within the organization and its environment which would make this effect more likely to happen.

While considering physical dimension of an organization we can find that this is acting as it does in a space-time continuum which fits nicely with our own perception of reality. However, that is not to say that the physical organization is defined merely by its organizational objects—the office building, chairs, machines and so on. There are still abstract forms to be accommodated which can give purpose and cohesion to the otherwise lifeless lumps of metal, wood and building materials. In particular, people, who form the workforce, would be no more than a social collection without them, but with them they can be resourced and organized into an efficient transformation process.

Therefore by abstract forms within physical organization, structure, management, hierarchy and information systems. The last item, information systems, details its physical organization and not its logical organization, which is included in virtual organization. The physical technology used in the transformation process can be termed as resources.

Technology, in a physical sense is a resource; in a perceptual sense, through knowledge and technique, is part of virtuality, and as a dynamic process is an enabling mechanism. The output of an organization has also to be considered when looking at the physical organization. Its form will vary from organization to organization. If it is a manufacturing firm then one would expect to find an output at the end of the process which is physically identifiable, such as a car or a piece of machinery. If, on the other hand, the firm is in the service sector, such as a bank, then the output is not so tangible and could indeed be described as having virtual characteristics.

Perhaps some outputs are more orientated towards one side of the organizational dichotomy than the other. For example, a bank's output is information in one form or another, and this would be inclined toward virtuality, whereas a car manufacturer's output is located at the physical end of the continuum. This has implications for organizational effectiveness.

In systems terminology, the organization is an open system, that is one which interacts with, responds to and is changed by its environment. Another characteristic of this model is the two blocks headed virtual and physical. These represent the dichotomy between the abstract, perceptual aspects and the more concrete, physical things. Both blocks are of equal size to represent equal importance and interdependence. They can be regarded as two equal parts of the same organization, or perhaps a little more contentiously, as two competing suborganizations with a certain degree of independence.

Each block is divided into two. The first section in both shows a typical cross-section of the elements of which they are composed. Thus aspects like power and knowledge are virtuality-orientated, whilst resources and production are physically-orientated. Neither list is by any means definitive. In the same way that Easton argues for simplicity in his model of a political system without sacrificing workability, it is the principle rather than the specific we seek. With each particular organization the content of either virtual or physical organization may differ in some way, but the operating forces will nevertheless work on the same principles. The other part of both the virtual and physical blocks are, as it were, mirror images of one another. They both comprise the three major elements of organization, either being virtually-orientated, hence located in the virtual block, or physically-orientated. Each is represented in the model as linking both the virtual and physical blocks to demonstrate that there are both virtual and physical qualities in all three elements.

The physical aspects in the information network, for example, can comprise the equipment and the functional layout, whilst the information itself comprises the virtual side of organization, and so on. The locations of the components of both the virtual and physical organization have been oversimplified since they cannot be represented in two dimensions in any other way. For example, virtuality factors such as power and knowledge are not separate from but part of the organizational element, political process; or physical aspects such as management and resources can also form part of the political process. The boundaries between all components are not as definitive as the model suggests: there is a great deal of blurring and overlap between them all.

Our world is like a prism which changes through different perspectives. We view it one way and power aspects or production aspects on their own come to the fore. We view it another way and another system such as structure is more clearly seen. No model can fully represent such fluidity.

Enabling mechanisms—the technological and the decision processes—are represented as being outside both blocks because they are seen as linking mechanisms. The process of making a decision, for instance, links the physical with the perceptual. An individual may decide to rearrange company resources in some way and in so doing not only physically change the company but also change employees' view of it. Or the technological process converts people's understanding of their world into action in the physical world. They are the links of communication and the life blood of the two worlds. Each, through these processes, feed the other. Neither can exist without the other, but nourishment is passed on from one block to the other after environmental stimulation. So these two processes are an important transmission mechanism and any effect in one block finds its impact in the other through these.

It should be stressed that we are examining processes rather than technology or decisions *per se*. Thus, like every other component within an organization, they are located in either virtuality or the physical dimension. Technology has physical attributes as a resource but it also has perceptual attributes in terms of knowledge and technique.

Decisions are the consequence of virtual aspects but they are also linked to physical organization through the structure and functional order; in this sense they are no different from other elements. Their processes, however, are different and this is what makes them enabling mechanisms. The advantage of taking a systems approach is that we can quite easily adopt different levels of analysis without forgoing theoretical linkage with those already established.

In the case of our model, we have been looking at the firm in terms of its subsystems, in particular the virtual and physical organization. It is now time to take a step upward, as it were, and to examine the firm as a whole interacting within an external environment, the system and its suprasystem. But we shall take with us the experience gained from the previous sections and see how it applies to this wider dimension. In so doing it is hoped to demonstrate how business organizations can be affected by the relationship between virtuality and physical organization.

We need to convert our model from a lifeless description on paper to a working process. The principles, the elements and the relationships remain fundamentally the same but our perspective is different. The organization boundary is also important because it can contribute to the nature of the internal forces within the total organization. These forces are the consequences of interaction between the elements of organization. In our demonstration these can be represented by two magnets, each placed against the side of the box, north and south. The magnets are strong enough to dominate their half of the box with a decreasing influence in the other half. Thus their influence will be dependent upon two factors; firstly, in which half of the box any potentially controllable body is located, and secondly, how near the centre that body is. The nearer the dominating magnet, the greater that magnet's control. There are two magnets, one on either side, to reflect the positive and negative effects that these forces may have on an organization with given characteristics. One magnet is always representative of the positive effects, the other always the negative effects. However, one type of force may not always be negative or positive. It could be positive in one firm and negative in another. Much will depend upon the individual firm.

For example, the same management stance within a banking organization would have different effects in a manufacturing firm because their different structural and market characteristics, etc. bring different influences to bear upon the structure of each. As such, this management stance might prove suitable for one and not the other depending upon whether the particular force was favourable to the particular organizational characteristics or not.

We need to establish a mechanism within this model to represent the relationship between the virtual and the physical organizations. Each sphere represents one of the organizations, and has the rather dubious physical property of being able to increase or decrease its influence in relation to the other by physically increasing or decreasing its size. Thus the larger one sphere is in relation to the other, the greater the influence it has over the other. Any such change takes place through exogenous force stimulation, that is a change factor created either in the environment or within the firm which has an impact upon the internal consistency of the organization. The whole mechanism is then perched on a fulcrum and can turn a full 360 degrees, attracted by the positive or negative magnets at either end. How the models works will depend on three factors: the degree of influence of one sphere over the other; the attraction characteristics of the internal forces, and the type of exogenous forces involved. The idea of the contraption is to establish, with a given set of internal forces, the equilibrium and balance location of both spheres.

The nature of the mechanism that controls them will mean that each will be in opposition or contradictory to the other. Therefore if, for instance, the virtuality sphere was located in the positive half of the box, the physical organization sphere would in turn be located in the negative half. This is not due to the limitations of the demonstration, but a deliberate attempt to reflect the antagonistic and competitive relationship between the two organizations. They cannot exist without each other but neither can they exist together. One exception to this, however, is when both spheres are equidistant from the extremes and thus still opposing one another though not in contradiction but in neutrality. This is one of the major conditions for equilibrium.

In most cases, however, this state will not be achieved and the spheres will be in contradiction, the degree of which will be determined by their proximity to the opposite poles. The extreme is when the two spheres lie vertical to the plane, one aligned fully to the positive and the other fully to the negative. So what can we gain from this that will be useful to our assessment of organization? The dominant organization (physical or virtual) will always be attracted to the side of the box most reconcilable to its characteristics; by default, therefore, the weaker one will align to the other side. Within the framework of our metaphor we could then state that wherever the dominant sphere is positioned (negative or positive) its influence upon the organization's effectiveness will be reflected by such positioning.

For example, if the dominant sphere was virtuality and was located in the positive side of the box, then virtuality would have positive effects upon the firm in question. The game can also be extended by changing the magnets and box, thus representing a change in the characteristics of the organization, and making a consequential effect upon the forces of the organization.

The virtual/physical mechanism would then act differently. There would still be only one equilibrium point accompanied by its innumerable balance points, but how these are achieved may be in slightly different ways. The model portrays an organizational environment dominated by the relationship between virtuality and physical organization. By their very nature, in that each is located at opposite ends, they must be in contradiction. Their characteristics and their relationship are governed not only by the technological and decision processes but also by a range of elements and subsystems which themselves create the internal and exogenous forces. And with those given characteristics virtuality and physical organization form a dynamic status quo which changes in accord with their environment. Their physical movement as represented in the model is obviously metaphorical, but it does demonstrate the shifting patterns of dominance one organization can have over the other. Extending the metaphor slightly, whether the virtual sphere is positioned in any particular part of the box will depend upon the interplay of forces which influence it and its competitor. If negative forces happen to be in greater sympathy with the dominant sphere then it would be located in that region. In other words, the location of the dominant organization determines the eventual characteristics of the total entity.

Wherever, in reality neither organization (virtual/physical) would be located physically, but abstractly through a series of complex relationships which can only be identified in each individual case. But what if the dominant sphere does not suit the business characteristics of the organization in question? We use a banking corporation as our example. We know, for instance, that the nature of its business makes subsequent characteristics more akin to virtuality rather than physicality. This is because they deal in perceptual exchange rather than physical exchange in terms of product. This then forms part of the characteristics of the bank's external environment.

But if through management action the banking corporation is more physically inclined than it should be we would then have a situation whereby the firm's characteristics, dominated by the physical organization, are contradictory to its environment which is dominated by more perceptual aspects. It is predicted by this model that physical organization would align itself, to a greater or lesser degree, to the negative effects. As a consequence the bank could experience factors contradicting its effectiveness, such as inertia, lack of growth despite investment, and large scale inefficiencies. None of these could be adequately explained by traditional theory because it is likely that, on the face of it at least, the structures of the firm seem reasonably sound. Quite apart from an interesting new aspect of organization that we gain, this approach also enables us to examine to a greater depth the impact of information technology upon any business enterprise.

Our perspective within a traditional, theoretical framework could blind us to the more appropriate paths of analysis. That is not to say that the traditionalist view is now incorrect, merely that it does not highlight those things necessary to the understanding of the impact of information technology. What this proposed model does that the others do not is to emphasize a dichotomy between the physical and the perceptual aspects of organization. In so doing it enables us to appreciate just how fundamental the introduction of computers and the like can be, reaching far beyond the efficiency criteria usually laid down by management. The introduction of such equipment is a win/win situation, generally by improving efficiency and thus increasing the firm's effectiveness. However, this may not be the case.

For example, a manufacturing firm with a traditionalist management approach introduces a computer-driven production line. We shall assume that prior to the introduction of the computer the firm is in the fortunate position of being in equilibrium as well as being in balance. That is, in terms of our metaphor, the two spheres representing both physical and virtual organization are in neutrality lying east/west. However, given the nature of the firm's activity we shall also assume that its dichotomy is dominated by the physical organization. This is still in keeping with the firm's equilibrium state, since all forces generated will produce a neutral effect. Change can occur but within the framework set by the equilibrium. We therefore have a firm which is stable internally and also, because of its dominant physical organization, in harmony with its production-orientated industry.

Against this background, if we now introduce the new computer-driven production line, we can not only analyse the effects of a new technology but also use a working example to gain a further understanding of the proposed model. The most obvious impact is a functional one, in that departments and line function are reorganized. As such, the effects are initially found within the physical organization, but like the ripples in a pond radiating out from the impact of a stone, the effects spread through to all parts of the organization. In general, however, we perceive only the first effect, in the physical organization, since it is the most akin to our abilities to understand. The physical impact of the information technology is translated into a perceptual impact through transmission by the enabling mechanisms. Once planted there, the characteristics of information technology encourage considerable growth of the virtual aspects of the organization. Depending upon the size and vigour of the system implemented, the virtual organization could indeed become larger than its originally dominant physical competitor.

Because information technology has created a dominant virtual organization the firm is now driven by negatively based forces which serve as a major dysfunctional influence upon the stability of the organization. Managers then find themselves in a classic position. They see effectiveness declining when it should be increasing, despite, perhaps, an increase in production. The criteria they have employed for implementation, being physically orientated, concentrate upon efficiency. Their perception of what is happening is also physically constrained. Therefore their actions for solving the problems are targeted at the physical organization. This only serves to exacerbate the problem. Since they possess no effective means of analysing what is going on, managers all too often put it down to their company's inability to utilize their new technology. They develop yet more physically-orientated training programmes to overcome their perceived difficulties. In fact it is more likely caused by the firm's inability to internalize their new technology. But managers, because they do not understand, rather than abandon the project or restructure the organization in a more suitable way, hire consultants who recommend yet more technology, which only exacerbates the problem still further. This type of vicious circle is all too common. Many firms do not even start in equilibrium prior to information technology implementation. Most are internally balanced but their dominant organization has generally been driven into a positive relationship with its environment.

Organizational dynamic

There is a sense of movement attached to all decisions: a sense of changing or reaffirming direction. For example, when we move jobs or emigrate or even decide which house to buy, these are all focal points in our lives which tend to drive us towards ultimate objectives or destinations. They are also constraints because they determine, to a greater or lesser extent, the direction we must go until the next focal point. In hindsight we might be happy or sad about some decisions. Looked at individually, one particular decision may give much cause for regret and yet a deeper analysis reveals that such a mistake eventually lead to a substantial improvement. One bad decision, for example, could cause an individual to be dismissed from one job which enables her to get a far better one. We intuitively know that our lives make sense through an examination of not one but a whole range of decisions, and more importantly how they relate to one another. It is only by doing this that we could answer the question, 'Where did we go wrong?' Similarly with organizations. They are collections of decisions taken over a period of time and driven by particular focal points. If we are to understand them and how they have achieved a certain position at some point in time, then we must look not to one decision or its process—no matter how integrated that analysis happens to be—but to a series of decisions interacting with the elements of the organization.

The decisions, very much like the elements of organization, are seen as the consequence of the here and now so that a decision is a now phenomenon rather than one linking into both the past and the future. It comprises an organization of five major systems each linked with one another, and therefore each dependent upon, and affected by, one another. It is by no means definitive in the sense that there are many other models with substantive variations. It does, however, serve to demonstrate a point. In our acceptance of the importance of decisions within an organization we have established an extra veneer of complexity. We know that people make decisions within firms as everywhere else, but we also have models that describe and prescribe the decision and its processes in detail.

In the majority of cases, though, these models are maintained, and perceived, separately from their organizational counterparts. This affects the way we regard the decision. It is as if decisions are taken in a different dimension, and fed back, metamorphosed, into the organization. We have, on the one hand, a firm and all its activity, whilst on the other we have decisions somehow separate and to one side. We talk of decisions being integrated into the environment and demonstrate quite strongly how, but at the end of the day we do not have one composite model of organization and decision process.

We have decision models with organizational undertones or organizational models sometimes with decision process undertones. How, then, does this theoretical dichotomy affect the nature of our models? In a few words it makes them static and one-dimensional. These models are not working models as it were, they are static snapshots without temporal or relational mechanisms. Those aspects are explained as side issues outside the body of the model. Yet to understand the essence of an organization a model must be able to capture both temporal and spatial positioning. That is, an action within the organization is affected by other actions in the past or in another part of the firm. Perhaps no model can ever hope to do this perfectly, but at least the inclusion of decisions into one composite model of organization may further this end.

Models of organization are not particularly realistic because they do not incorporate the decision process in an appropriate way. Such a process is the dynamic of organizations, driving and compelling them to change or to maintain their status quo, and linking one area to another in whatever perspective we choose to take. But the decision process also enables the firm, through the model applied, to have its own historicity.

The decision as an organizational dynamic is not a simple concept to explain because much of it is abstract. It could be usefully understood in terms of integration of the decision process into the interactive relationships of all the elements of the organization. In Leavitt's model, for example, the two-way arrows established between the systems as links, can be viewed as decision processes. How does this help? The short answer is that it enables us to understand organizations for what they really are.

The conceptual frameworks of these models need not necessarily change significantly, but the emphasis within them could well shift. The links are no longer inert abstractions to be explained away as a side issue but an integral part of the process. The reason for this is that decisions are taken by people, and organizations comprise people, certainly organizational cohesion is gained through their perceptions. Thus to perceive decisions as the linking mechanism of a firm is to pull the perceptual/people aspect of organization back into focus once more.

Firstly, all abstract systems such as structure, tasks and technology must involve people, because they can only gain form by people's perceptions. In other words, there would be no technological system without people to give it life, just a pile of junk. Therefore there is an implied human involvement in all these abstract systems and so the decisions are quite obviously emitting from them and linking into other abstract systems via their own human elements. At the end of the day firms cannot be firms without their employees.

Secondly, the emphasis on a people activity as a linking mechanism does tend to place a greater importance on the people systems in any organizational model. As such it seems reasonable to assume any decision process originates from this system. In other words, the link between the systems of an organization is not only the decisions of that organization but also its people system. This system in such a role forms an interface between all the other systems. The organization is still represented by five major systems, each still dependent upon and affected by one another.

The established culture of an organization can help or hinder its development and design. In all cases, people are needed to give it meaning, since the relationships between culture and structure are not established in reality but in people's minds and therefore appear real. Thus the people system, or perhaps the mind system, must come between both the other systems to give them their form. The argument is similar for the other system relationships. This perspective is not a return to the central individual in the classical management ideal for the following reasons.

Firstly, the people system may be located centrally in any model so that inputs/outputs from other systems have to pass through its domain. But that does not mean such a system need have any more or less influence on the other systems. The nature of such relationships is defined by the particular model presented. An example of a model using the people system as part of the linking mechanism can be found in Kast and Rosenzweig's book.

Secondly, the concept we have of the people system, if not indeed of the whole organization, is too simplistic.

Since the organization can only take form within the minds of its people, their system is the arena in which all aspects of organization ire given meaning.

To reiterate an earlier hypothesis, such transformation from cognition to activity comprises two domains: the physical and the perceptual. The physical domain represents the mind-independent aspects of organization, whereas the perceptual domain represents the coming together of minds to interpret a part of the world in a particular way.

The decision provides a way, through the organizational elements, to link the perceptual and physical domains. This does not allow the individual self-determination in the classical management sense; their minds, nevertheless, form the organization, compelled and driven by forces beyond their perception and control.

The decision must be an important factor in any model of organization. Indeed, an organization model is lifeless without the decision process to give it dynamic qualities. There are many models to be had; the decision should play a part in each, although in many cases any inclusion of decision processes would be contrived because the analytical framework of most models has not been designed to be dynamic or systemic.

The decision, and its process, is thus shown as a dependent variable rather than as a determining one. It has already been argued that a general model of organization must be systemic. Three major systems of an organization have been identified which together give a model true systemic qualities, rather than contrived ones from a collection of systems which do not reflect a sustainable model. There is no people system because all three systems are people systems in that they take form within the employees' minds.

Nor are the organization's decision processes a system of the model since they are not identifiable as a collective, but rather immersed once again in the other three systems. But decisions are an important enabling mechanism by transforming perception into action. It is essential therefore that the decision is fully integrated into the organizational model.

With such an objective this section will gather together the many strands of the discussion on decisions so far developed to form a composite model. This will be presented in two dimensions.

Firstly, an examination of the relationship between each of the three major systems of an organization and the decision process.

Secondly, since our particular interest is in technology, by applying to that a technological overlay, determining especially the impact of information technology.

The transmission mechanism for the organization's information, enabling it to get from one system to another. The decision playing a crucial role in this environment.

Decisions could be imagined as perceptual roundabouts changing the direction and type of information flow. Not only that but they also allow the modification of information and hence organizational action through past experience. People bring to their decisions a knowledge of other decision outcomes. It is through these perceptions that the information network becomes more than a here and now entity. It is linked in time to all those other previous decisions creating in effect an organizational historical continuum. This is saying more than that a firm has a past: it is recognizing that within the organizational process there is continual interaction with the past through its decision process.

The link between any information system and its users are the decisions that those users make. All action is preceded by a decision, no matter how petty, and information (or data) fuels that process. Thus when we talk of user requirements we are talking of the ability of the user to make appropriate decisions. The information network involved must therefore fit like a glove to the user's decision-making needs. If it does not then, similar to a glove which does not fit, there is no comfort in the match.

In the analysis of any information network, the positioning of decisions as focal points is important and dependent upon three factors:

— The technology involved.

— The political process.

— The structure of the organization setting the constraints to any interaction.

As far as technology is concerned, the impact upon decision positioning is obvious but often not considered. If the technological process is an interface between us and our environment then our perception of that environment will be affected by it and hence our decisions. Technology demands action of some form; the action in its turn demands decisions.

The decisions will then follow the technology to where it has been placed in the organizational system. Such a positioning will affect our environmental perception and hence the decisions we make. The argument is circular but demonstrates an intuitive logic that if we rearrange our technologies within a firm, we may well end up changing the characteristics of its decision-making process. For example, the technology involving a manually driven cashbook requires the allocation of a decisional focal point.

A change in production line technology can change the decisional focal points and hence the nature of management decisions. If, then, the nature of decisions and their location within the information network change, it is reasonable to deduce that the characteristics of the information network itself also change. The overall number of focal points may increase or decrease thus affecting the flow of information. There could be a change in who can access particular information or the number of persons creating it, and so forth.

All these aspects serve to alter the established patterns of flow which comprise the network. The impact of this on employees' perceptions is to compel them to act differently, sometimes pathologically. To seek to accommodate the change they may implement new structures around them or use information generated in different political ways. It may be that they themselves perceive their environment to be different and thus act accordingly.

The consequences for the management of any organization are that to change the established technology may change the way employees make decisions not only through the direct impact of technology but also through the changing nature of the information network. By implication, the concept of data is attached to the physical aspects of an organization. It exists irrespective of whether it is perceived or not, like any physical object in an organization. It is a fact that there is a red carpet in the managing director's office whether it is seen or not. On the other hand, information is the consequence of a cognitive process and thus aligned to the perceptual aspects of a firm. Knowing that the managing director's carpet is red is important when ordering curtains for her office. You must be aware of that fact and find it important enough to act upon.

There are two factors to consider in relation to this added dimension. Firstly, how does such a dichotomy between data and information affect the information network? Are there two levels, for example, one physical and one perceptual? Secondly, in the light of the first point, does such a problem affect the focal points of decisions? Decisions are perceptual processes, so can they operate only in a perceptual environment?

The answers to both these questions depend upon how the firm treats its information, in particular whether the members believe the firm itself owns the information or not. The collective belief of the employees will determine whether there is a difference between data and information, which will affect the way that decisions are taken. How much linkage there is with either the physical or perceptual domain will in the end depend upon the perceptual interpretations of the people involved.

The design of a particular firm will determine the position and particular characteristics of focal points on the information network. The previous section highlighted the effect that technology, in particular information technology, can have upon the decisional focal points.

The organizational structure too has a strong influence on their nature and positioning. This is because the structure sets the framework into which everything else, including the information network, must fit. The way that functions or hierarchies are arranged, for example, will determine the points at which decisions are to be made (focal points), which would then reflect on the information network itself. In other words, gatekeepers within the information network are, partially at least, generated by the design of the structure.

The positioning of decisions within any process reflects the structure of that process. But we have also determined that technology can change the position of decisions within a process. By inference, therefore, if the decision positions are changed by technology then the structure should change also, otherwise there would be a mismatch. For example, a particular manual cashbook system has one decisional focal point. This reflects the structure of the system in that one person enters up the cashbook and makes the decision. If the cashbook is put on the computer the number of focal points increases. The manual cashbook structure is no longer viable because that person would have now to span several functions. Therefore the structure has to adjust to accommodate this, otherwise the new system would not be workable. Much of this may seem trivial. It is obvious to many that if a new system is introduced, work practices must change. What is not so obvious is that those changes must reflect not only the need for structural change but also the need for change in the information network. The link between the two is the positioning of decisional focal points. The bottom line is that there are structurally imposed forces which push for a particular decision positioning profile within the information network. There are forces imposed by technology which also push for a particular decision positioning profile. The outcome tends to be a compromise or balance which is reflected in the nature of the information network. There is, therefore, by definition a balance between an organization structure and its information network. Any further change is potentially dysfunctional unless allowed to re-establish an equilibrium. What must be realized is that if there is a change in one of these aspects, there must a corresponding change in the other two. This is particularly critical in the case of computer technology implementation but is more often than not ignored, if perceived at all. It is the decision process, especially its positioning as focal points, which is the linking mechanism.

The positioning of decisional focal points will by definition give rise to the positioning of decision owners. Dependent upon the relative positioning of one focal point to another will be the power of that decision owner. Those who have information which is valued in a particular organization can achieve considerable power from it. The ability to gain possession of valued information is itself dependent upon an individual's position within the organization. This is not only in a hierarchical sense but in a locational sense as well. If their function commands a certain position within the information network which can trawl and control valued information they are, in effect, gatekeepers. As gatekeepers they can control decisional focal points either directly or indirectly. Pettigrew in proposing the concept of a gatekeeper saw this as being an important factor in understanding any political process. Others in the organization accept the gatekeeper's control of important information and are thus willing to accede to his influence, which gives him power. The basis of his power has arisen from the fact that he has been placed in an earlier position on the information network which enables him then to feed either other gatekeeper functions or decisional focal points with that information. Power, therefore, is relative to its particular gatekeeper or decisional focal point on the information network.

The positioning is defined not only by organizational structure but also as a consequence of other factors such as personal credibility, knowledge and so on. A firm's hierarchy, for example, is an attempt to fix individuals' positioning on the information network. Gatekeepers and decisional focal points are not necessarily one of the same thing. The two aspects are on many occasions combined whereby a gatekeeper owns a series of decisions which are focal points. On the other hand, a gatekeeper can also supply and not own focal points. The difference between the two reflects the different characteristics of the power relationship. The former is more likely to have objective power in that he/she is an important person placed formally in a good position in the hierarchy—a manager, for example. The latter is more likely to possess subjective power in that he/she is in an important position on the information network but not necessarily an important person. This person—the boss's secretary, for example—is generally a supplier of information to others who control the decisional focal points. Power comes to the managing director not because he is the son of the owner, although that may have important implications, but because of his position in the information network and the decisions that he owns. The owner herself is important because she owns decisions which could close down the firm. But within the context of the organization she is not powerful because those decisions do not relate to the internal political process. The link between the political process and information technology is the condition of the information network expressed in terms of power relationships. Change the technology and those power relationships may well change too. If the decisional focal points are relocated by certain technology, their owners or gatekeepers will either gain or lose power. This will then affect their dealings with others and hence the political process.

If we think of an organization as possessing a balance of forces rather than being a balance of power system *per se* then we would be thinking along the right lines. This in effect means that an organizational system does not have a specific, predetermined goal (to balance its power) but rather that the goal is to balance its many contradicting internal forces in order that it can survive in the short run. The organizational system is subjected to a dynamic balance which can be located at one of any different combinations of forces. It need not necessarily be in equilibrium which is just one point where all forces are equal. So that as with the political interpretation of balance, our balance is differentiated from equilibrium. This is indeed what differentiates the political balance from the already established idea of balance in organizational systems theory. A cursory look at the literature covering organization systems theory would quickly indicate an acceptance of the concept of a steady state, albeit on many occasions a purely temporary one. Unlike a physical system, however, this state is not unchanging, it is seen as an equilibrium moving from one state to the next and is termed equifinality.

An organizational system is seen as developing or changing along a ratchet-like historical process whereby there would be times of stability followed by times of change. The control mechanisms of the firm would thus guide it from one point in equifinality to another. These steady state periods are seen as being essential if an organizational system is to maintain its validity. In other words, a system which is not valid in the longer term breaks down into entropy. However, during the calm periods firms are able to re-establish their credentials as proper systems and also prepare themselves for the periods of change or upheaval which may follow. Such turbulent periods are seen as inevitable because of the open nature of the organizational system. Therefore, to survive, a system must change, but in doing so it risks entropy. And so to survive a system must also resist change in order to gain a steady state; a paradoxical situation which has confounded many organizational systems theorists. To this extent antagonists such as Silverman have rejected it as a viable explanation of organization.

Major weakness of organization systems theory is two-fold. Firstly, it is treated as a theory rather than a methodology. Secondly, the assumption that a system may be in a steady state or not—one or the other with nothing in between—is problematical. To remain balanced, and therefore valid, an organization needs forces which compel it to continual change. Systems theory does not seem to be able to reconcile the two opposing needs with its one concept. It requires the firm to abandon its balance in order to change. The resulting difficulty has been caused by the muddling between balance and equilibrium.

By adopting two potential steady states rather than the one we have allowed an organization the ability to be appropriately balanced but not necessarily in equilibrium. An organization can thus maintain an internal stability whilst in a state of change. This is essential because many firms are quite obviously effective even within periods of change, contrary to the implication of organization systems theory.

It is possible to have an almost infinite number of positions of balance, so that although balance must be achieved, if managed properly it is relatively easy to find. To establish equilibrium, however, is considerably more difficult. Indeed, many firms may never really achieve it, or may have lost it through inadvertent management action and never regained it. In the long run they are doomed to decline or fade away. Thus a firm can survive, certainly in the short run, in a state of disequilibrium, but the change which is occurring at second-order level is still, nevertheless, having a dysfunctional effect. And unlike balance, within any given set of forces there is only one and as such, is harder to find.

It would seem, therefore, that as in all other aspects of an organization the two levels of change-impact are in some way interrelated. An event stimulated at one level may have implications on the other. This has consequences for management because they might well be creating an effect within the structures of their organization which they had not anticipated. Quick management appraisal is the second-order level of change which causes the real problems for organizations. Management focus is very much on the first-order level, it is to that which it responds. Its action, however, stimulates further change on both first- and' second-order levels. The first level they are likely to be able to control, but on the second level the situation has been made doubly complex with change occurring on change. Thus the initial first-order change actions will more than likely not now be effective in inducing an appropriate change on the second-order level.

Balance is the steady state achievable after a first-order change. In many respects it could be seen as an operational change consequence, whereby the aspects of change are located within the specific firm's control boundary. Equilibrium, on the other hand, is only established or re-established after a second-order change. This is a far more fundamental concept and is associated with strategic aspects of organization. The implementation of information technology into any firm will affect it on both change levels. Its introduction will initially affect the firm's balance; by how much will depend upon the degree of impact.

For example, a new tooling machine on the factory floor which significantly alters the production process will have a considerable impact on that particular firm and thus affect its balance. A new typewriter for the chief engineer's secretary is unlikely to have much impact on the firm and thus unlikely to affect its balance. In particular, the neutralizing effects of the control mechanisms on dysfunctional forces of change were rendered inoperative. Its actions to adjust the control mechanisms seemed to be correctly done since it would appear that another new balance was established.

In this respect, information technology is no different from general technology. If we used a microcomputer as an example we would see that its impact may or may not affect the firm's balance depending upon the degree of that impact. Were we to introduce a microcomputer into a large organization we would probably find that its impact would not be sufficient to create an imbalance. On the other hand, if we were to introduce this same computer into a very small, owner-run firm, for example, then we are likely to find its impact to be considerable and quite easily bringing about an imbalance. In a large firm the effect of the changes described in the case study would have been barely measurable. The change factors would have been the same in either case but because the impact was different the consequences would also have been different. Balance is associated with first-order change, but the impact of that change has to be such that it can disturb the forces already at work.

Any piece of technology is to a greater or lesser extent an interface between the individual and the environment. We could say that a balance exists between the technology and the individual; this is more pertinent when applied to an organizational context. If a good part of the organization is formed in the individual's mind then their relationship with certain sets of technology will also determine how they see the organization and therefore how it is to be. On the other hand, how they see their firm will also affect how they relate to their technology.

An employee is part of the organization. Her perceptions and her relationship with the firm's technology feed into a group cohesion and steady state which is the organization. Quite often an organization is devised by the management alone and without the support of the individuals who are designated members of it. It is then little wonder that these things are rarely successful; an organization is not simply a set of rules and regulations. Managers are the organization's shepherds and no more, they alone cannot form an organization. The understanding of this is particularly important when considering the implementation of information technology.

By merely introducing it into a firm and developing different work practices around it we have disturbed the balance in the organization. Our perceptions have changed because of it and we no longer act in the same way. We may try to understand our work environment in terms of the old ways and find ourselves at odds with the new order. Or indeed, the technology itself may make us see things differently which do not fit into the established way of working.

We seem to operate in both a perceptual and physical organization, each affecting the other, driven by conflicting forces and linked by technology. The impact of information technology is not far short of catastrophic. Managers have to be skilful indeed to see their firms through such periods of change.

Our changed perceptions will compel realignments in organizational forces and the consequence can only be imbalance. No other technology can have such an immediate and potentially dangerous effect, yet we treat it as if it were merely other technology without realizing the havoc this may wreak. The irony is that one of the first casualties of such impact is management control itself. Management is essentially about controlling access to information by acting as gatekeepers. Information technology allows each of its users to see beyond these gates and access the lusher informational pastures beyond. The incumbent management structure becomes no longer necessary and managers are quite often by-passed. Their power diminishes. This in turn affects the way people within the organization interact with one another, which in turn affects the functional structure of the firm.

Introduction of information technology may not require just a one-off adjustment to gain a new balance. Much, of course, depends upon the size of its impact in relation to the firm involved, but if it is sufficient then it would seem that an almost unstoppable process is induced, something akin to a complete structural eruption of the organization. In the end much will depend upon management action and how sensible and sensitive it has been to whether the firm will survive or not, let alone come out better. Much will also depend upon the cohesive characteristics of the organization.

The balance of an organization, being the consequence of forces which are themselves influenced by these cohesive characteristics, is also thus affected by the way that information is treated. This is particularly pertinent when examining the impact of information technology. There are three aspects which must be considered in this instance. Firstly, there is the technology itself; secondly, the way information is treated in any particular firm and thus the ideal structure to accommodate that; lastly, the structure of the organization.

There will exist a series of balanced positions between all three which will enable the firm to achieve a steady state. To change any one of these would be to lose the balance and thus the firm's steady state. One force, such as technology, could then become more dominant than the others and attempt to drive the organization towards a state which would most suit it but not necessarily the firm. This situation does not necessarily preclude a balanced state; many healthy but technology-driven organizations are located at just such a position. But it is more likely, however, not to be a balanced state—or at best a temporary one—because of the domination of one force over the others. That is why many technology-intensive firms are so vulnerable to change. Balance, then, is never guaranteed, no matter how established it happens to be. In most cases management action is governed by a parochial perspective and does take into account that an action in one part of the organization may affect others. The tendency is to implement the technology first and to ask questions afterwards. The characteristics of the market, its producers and its sellers tends to encourage such an approach. Balance is such an abstract concept. It is no defence to depend upon the established ways just because they have been there for some time.

Organizations are dynamic entities, and even with an inert management they undergo change frequently. It often seems to be the case that whether an organization re-establishes balance and thus a steady state is more by luck than explicit management judgement. Even knowing about balance is not always helpful. The other aspect of steady state in an organization is equilibrium. The changes which affect equilibrium are second order and therefore not directly influenced by management. The irony is, however, that it is just this kind of change, leading to a shift in or the establishment of the equilibrium, that managements are most keen to achieve.

Nowhere is this more the case than in the implementation of information technology. There is increasing talk of using computers and their systems not as tools but as strategic weapons to achieve a competitive advantage. The point is that it is not that the technology produces more information and of better quality but rather that it produces the same thing in a more complex fashion and at a reduced cost. Because the initial learning and implementation curves of the new process are too costly for others to adopt, they are quickly excluded from the market.

Information technology initially affects the balance of the firm. This impact first shows up in areas which are not always foreseen by management. They either do not know what is happening and therefore no corrective action is taken, or they may well understand the impact and take the necessary action. These are all first-order change stimuli, and through management response a new balance may or may not be achieved.

Unfortunately such first-order activities may have further repercussions on the second order. If the firm is established in equilibrium it is highly likely that a changing balance will also throw the firm into disequilibrium. The logic of this is that given the resource framework of a firm there is only one point of equilibrium which corresponds to only one point of balance. If, on the other hand, the firm is not in equilibrium, such first-order activities could serve to drive it further from such a point. Another complication can be added to this: the responsive and initiating action of management. Throughout all this they are acting as if they are effecting a second-order change when in reality they are effecting change at the first-order level. Nevertheless, management's action does have profound implications for the second-order level. By acting as if they were initiating second-order change, managers develop inconsistencies at first-order level which could in the longer term change the relationship between the firm and its environment, which is a second-order change.

Information technology possesses a unique set of characteristics which would enable such a split to be permanent. It is not a normal technology in the sense that it is not constrained by the existing organizational framework. Through the individuals who use it, information technology can generate other logical frameworks of organization beyond the existing one.

4

Databases and Networking

For a communication to take place, both the transmitting and receiving entities must agree upon a common language, written or verbal. Although there is no universal standard for the coding of information in computers, all manufacturers agree upon the value and structure of the bit: a single cell having the value of zero or one. Bits can be grouped into four-bit quantities known as nibbles, and 8-bit quantities known as bytes. The description of the byte data structure depends entirely upon the manufacturer, although some standards do exist. Although most communications usually occur at the bit or byte level, applications may deal with other data structures that comprise of groupings of bytes. Depending upon the manufacturer, a word may be a 16-bit (two-byte) or a 32-bit (four-byte) data structure. Floating-point numbers, consisting of a fractional part (the mantissa) and an exponent, may be stored and interpreted in a variety of ways, depending upon the precision offered by the manufacturer and the number of bits available to represent the number (floating-point numbers can be 32-bit, 64-bit, or even 128-bit quantities).

How information is represented on different computers is an important issue in data communications because unless the entities involved in the communication can agree upon bow the information is coded, there can be no meaningful exchange of information. For example, if a file of ASCII information is transmitted to an EBCDIC computer, unless some form of translation is made available (i.e., the ASCII bytes are translated into EBCDIC or the EBCDIC computer can interpret ASCII), the information received by the EBCDIC computer may be meaningless. To make matters even more confusing, although two manufacturers may agree upon the character code, the internal organization or byte ordering of the computer's memory may differ from machine to machine. If data is transmitted between an Intel and a Motorola processor as a series of 8-bit ASCII bytes, the hardware ensures that each byte is read from and written to memory in its proper order. However, if the information is sent as a series of 16-bit words, the receiving processor will receive the bytes in the reverse order. Similar problems can occur when attempting to transmit 16-bit integers as pairs of bytes.

When two people talk, there are many techniques and, cues that are used to signal whether the information has been understood, if the information should be repeated, and when the other person can speak. These signals are not usually part of the information that is being conveyed, but the signals are necessary to allow the communication to continue. For example, if you want to gain someone's attention, you might preface what you're about to say to them with their name; however, the person's name has no bearing on the actual information that you want to convey. Other types of control information exist, as well: in order to determine if the receiver has actually received the information, the speaker may end what has been said with a question, expecting the receiver to respond to it. The additional information that is used to control the communication is known as control information. To distinguish between the information being transmitted and the control information, the non-control information is often referred to as a message. The extra information required to ensure that the communication can continue is known as an overhead. Although control information does impose an overhead on all messages sent in a communication, the overhead is intended to ensure that the communication can proceed and that the message is received correctly.

In a communication between two entities, messages are rarely, if ever, sent without some type of control information. The message, plus the control information, is sent in a frame or a packet. What is transmitted as control information depends, in part, upon the protocol being used. At a minimum, the control information should signal the receiver when a message is about to begin and when the message has ended. In situations where there may be many entities that could accept a message, the control information could contain a destination identifier which identifies the intended destination entity. A source identifier is usually included to permit the destination entity to determine the transmitter of the message. As an analogy, the frame can be considered an envelop into which the message, a letter, is placed. The destination address is the address on the front of the envelop and the source address is the return address. Some protocols may require that responses be generated at certain intervals during a communication. These responses, which are also a form of control information, must be distinguishable from the information within the frame, otherwise it will be impossible for the entity receiving the frame to determine whether it is a message or control information.

During a communication an entity may not receive the incoming message correctly. At this point it is necessary for the receiving entity to indicate to the transmitting entity that the message was not received correctly. For example, when two people are speaking, if one person does not understand what is being said or misses what is being said because of some form of interference, the speaker may be asked to repeat what has just been said. When a message is damaged or lost because of a fault on the communication channel, an error is said to have occurred. If a communication is to be reliable, the entities involved in the communication should be checking each message for errors; and if an error is detected, an agreed upon procedure whereby the damaged or lost message can be recovered should be activated.

During a communication, the information flowing between the entities must utilize some type of communication channel. There are many different media that can be used as a communication channel; for example, when two people talk on a telephone, the communication channel is the telephone system. Ideally, communication channels should be used as efficiently as possible, maximizing the amount of information passing from one entity to the other. The amount of useful information that flows between the transmitter and the receiver is known as throughput.

The trade-off is the cost of setting up a communication channel consisting of one path, or eight paths: eight times as many connections and paths are needed for parallel. One usually finds parallel connections within the computer or between closely coupled computers; however, over distances of more than a few meters, most communications are serial. Within the computer, bytes are moved in parallel channels. Before a byte can be transmitted serially, it must be converted from parallel to serial using a hardware parallel-to-serial converter. Similarly, the stream of serial bits must be assembled into a (parallel) byte using a serial-to-parallel converter.

In any communication, certain steps must occur before others. For example, in a telephone conversation, before the conversation can take place, one person must dial the telephone number of the other person, and before the person being called can answer the telephone, the telephone must ring. Once the called person answers the telephone, the conversation can proceed. Protocols often require the entities involved in a communication to be instep or synchronized. That is, one event occurs which is followed by another.

Continuing with the telephone analogy, once the communication has been established, synchronization is maintained, typically with one person making a series of statements, to which the other responds. At the end of the telephone conversation, both parties agree that the conversation is over and hang up. Synchronization in a computer can occur at any number of levels. Two communicating processes must exchange synchronization information, to ensure that no messages are lost. Synchronization is achieved by the use of an external timing device, typically a clock.

At lower layers, synchronization must be maintained by the communicating computers at the frame, byte, and bit levels. Since the computers are operating independently, the receiver must "know" when the next bit is to arrive. This can be achieved by having each computer maintain a clock that is *in* sync with the other computer's clock. For example, at each "tick" of its clock, the transmitter sends a bit; while at each "tick" of the receiver's clock, a bit is read from the channel.

The term synchronous communication is applied to those communication systems that can send a stream of bytes with only periodic timing information. The term asynchronous communication is applied to those communication systems that require each transmitted byte to be prefixed with timing information. Communicating entities can also use timing to ensure that the communication is still in progress. For example, if an entity does not receive a response to a message within a given time period, the entity can take action to determine the cause of the inactivity. The inactivity could be due to a variety of reasons, including a break in the communication channel, or the other computer may have crashed. Many protocols require special frames to be sent periodically; these allow each entity involved in the communication to determine that the other entities are still active.

Data Terminal Equipment (DTE)

In any communication, the underlying facilities supporting the communication should be transparent to the entities involved in the communication. For example, when using the telephone, the people involved in the communication should not be concerned with the details of how the telephone system actually places the call. A computer can be considered to be a device that, when given input, processes it, and produces output. If a computer is to communicate with other computers, it also requires some type of connection. A computer that serves as a point of collection, use, or transfer of data, is referred to as Data Terminal Equipment (DTE).

To the vast majority of people who use computers, input takes place through the keyboard. Most keyboards are equipped with more than the standard typewriter QWERTY keys; for example, function and cursor control keys are also available. Over the past decade, a variety of specialized input tools have been developed, including optical scanners, to interpret the bar codes associated with items such as supermarket goods; voice-to-digital units, to allow people to talk to the computer rather than type; magnetic strip decoders, to read the magnetic material found on the back of most charge cards; and pointing tools such as the mouse and trackball, to allow a user to select an object on the screen. Although most DTEs support either ASCII or EBCDIC internally, input to the DTE need not be either. The PC keyboard is an example of an input device which produces its own character code which must be converted to another character code (typically ASCII), before being processed. For the most part, DTE output is visual; originally output was textual, either on hardcopy (paper) or softcopy. Today, output can be a bit-mapped image including icons (still-pictures on the screen), facsimile (fax documents), and animation. Monochrome CRTs are being superseded by colour and liquid crystal display (LCD) terminals. It is worth noting that a DTE need not be associated with input. For example, a line printer (a DTE) produces output and is connected to a computer; however, the line printer need not support input.

By definition, a DTE must have at least one connection to another computer (a DTE), otherwise communication cannot be achieved. Connections are typically physical, consisting of insulated wires or glass. In longer distance communications, the DTEs need not be connected physically. For example, information can be passed through the air via microwave communications, or through space via satellite communications. It is worth noting that although some DTEs do not support input and output directly, input and output can occur across the connection. For example, some highly specialized computers do not communicate with humans directly. Instead, all input and output is passed to the specialized computer from an external processor: humans communicate with the specialized machine via the external processor. In this situation, the specialized computer does support input and output, but only through the connection. Typically the most common type of DTE interaction that users experience involves a terminal connected to a remote host. Terminals usually operate in one of two modes:

1) *Block mode*: A block mode terminal is one in which the information entered at the terminal by the user is not sent to the remote DTE until the terminal receives an explicit signal from the user. Examples of block mode terminals include airline reservation systems in which information is accepted from a client and verified before being sent to the remote host for processing. Block mode terminals are typically CRTs.

2) *Character mode*: Character mode terminals accept single characters entered by the user and forward them to the remote host. In some situations, the character mode terminal will buffer one line of characters before sending it to the remote host. The characters entered by a user can be displayed from either the local or the remote DTE:

    — *A remote echo* occurs when a character is entered at the user's local DTE and the remote DTE is responsible for outputing the character. The local DTE accepts the character and transmits the character to the remote DTE; the remote DTE performs whatever processing is required on the character and returns the character to the local DTE for output. Remote echoing is often used in applications such as screen editors, that do not expect the user to end each command with a delimiter such as a carriage return.

    — *A local echo* occurs when the user's local DTE is responsible for echoing each character entered by the user. Local echo is often used by block mode terminals; when the user types ENTER, the information is transmitted to the remote DTE.

Active database systems

By implementing the activity components as an integral part of a Database Management Systems (DBMS), active functionality is rather tightly coupled to the DBMS behind it. Thus, the active DBMS becomes part of large monolithic pieces of software. Such software is difficult to implement, validate, maintain and adapt. Even where active DBMS have a layered system architecture, with the activity components residing "on top" of a conventional DBMS, the active functionality remains tightly interconnected and as such bound to the particular target DBMS. In either architectural approach, a substantial effort is required to adopt active functionality for various DBMS. It is close to impossible to develop activity mechanisms that can be ported from one DBMS to the other. Today, a few commercial DBMS offer restricted active mechanisms while the more expressive ones are only found in research prototypes. Moreover, active functionality tightly coupled to a concrete environment hampers its adaptation to changes in the information technology scene. Just consider the present change of information systems in environments with several heterogeneous and distributed information sources. Active mechanisms, e.g., complex situation monitoring or cooperation and coordination should take into account heterogeneity and distribution.

A further weakness of the tight coupling of active and conventional database mechanisms is that active functionality is not usable on its own, i.e., without the added DBMS features. However, active functionality is also needed in applications which require either no database functionality at all or just some like persistence. Thus, active functionality should be offered not only as part of the functionality of a DBMS, but also as a separate service which can be combined with other services like a persistence service. In this way, users could develop "lean" solutions without much overhead due to unneeded components. As a solution we investigate the provision of active database mechanisms as an individual service. In other words, we unbundle active functionality from the DBMS. Thus, we follow a general direction that database research is currently about to take, namely to provide individual database management services that can be used and combined in a variety of ways and in a variety of environments. Note, components for database construction have been developed earlier, however, not with respect to active functionality, heterogeneity, and distribution.

The unbundling process starts with a domain analysis of active DBMS-style active functionality. The main task is the identification of components and the cooperation between them. This leads to several configurations. The motivation and the advantages of unbundling active functionality have been presented in. In this paper we investigate in much more detail the unbundling process and its impact on the design and implementation of concrete systems.

Considering database management systems as a form of traditionally large and monolithic software systems, it makes sense to build them from a number of cooperating components, and perhaps hope to provide these components for other application areas as well. A still relatively new DBMS part, with increasing importance for supervision, coordination, and cooperation in today's more and more heterogeneous and distributed IS, is active functionality as known from active DBMS, which we assume the reader to be familiar. Unbundling active functionality from an active DBMS means first to separate the active part from the active DBMS and then eventually to break up this active part into units which provide specific services like detection of events, definition, management.

Today, active mechanisms are always tightly coupled to a specific DBMS. Typically, active functionality is rather restricted and provided only by few DBMS. There are many applications with active behaviour where a DBMS is used, which fulfills almost all application requirements, but offers no or only a restricted active functionality. With independently usable activity components, passive DBMS can more easily be enhanced by activity. This eases the implementation of active mechanisms and should contribute to wider utilization. Use of active capabilities in broader contexts separate from a DBMS.

A range of applications like workflow management, environmental monitoring, etc. require active functionality. However, they do not necessarily require the whole spectrum of database functionality but only parts like persistence or query facilities. However, tight integration of active and database mechanisms in one system forces users to accept both, the entire database functionality and the active functionality. Instead, a separation of active and conventional database mechanisms would allow the use of active capabilities without any overhead due to unneeded components. This fits well into an environment of combinable services or OLE/DCOM. It is natural to add to this infrastructure higher-level services for active functionality.

Applications could then combine active functionality with other services. Use of active functionality in heterogeneous environments. Today's database applications often refer to several heterogeneous and distributed information sources. The need for active functionality in heterogeneous, distributed environments is obvious in the area of data warehousing and has also been reported. The impact of heterogeneity on active DBMS is primarily the richer set of information resources that must be monitored. This means that relevant information may not only reside in a database system but also in files, on web pages, etc.

Furthermore, checking complex situations like an environmental pollution, a business opportunity, or an emerging traffic congestion usually requires more complex computations than supported by database conditions. Typically, some specific analysis tools have to be invoked. Thus, such analysis and processing tools may become important resources as well. Hence, the means of the interaction between a service offering active functionality and the heterogeneous environment becomes much more diverse. Tailoring active functionality to the application profile. In the more general environment sketched above active functionality plays more roles than what has been used in active DBMS. Supporting advanced active functionality to fulfill the requirements of every application area is not a solution, because there are many cases where the system is overloaded with functionality which is not necessarily needed. Active mechanisms should be tailorable to the application profile. Consequently, collecting all active functionality that could conceivably be used by some application into one system is not the answer. Instead, the unbundling of active mechanisms from the DBMS should be continued into the unbundling of these capabilities themselves.

The unbundling process consists of two major steps (a) the domain analysis where we identify the functionality covered in terms of the services provided and (b) the description of the unbundled system, based on an architectural model, in the form of a specific architecture. In case of unbundling active functionality the domain analysis consists of a review of existing work. This is feasible because after around 10 years of research in active DBMS the basic concepts and functionalities for active behaviour and especially the semantics behind them are well-understood and established in these systems. This has recently lead to a consensus on those base concepts, which spawned several comprehensive overviews on the concepts and dimensions of active functionality in active DBMS.

In order to describe the architecture of an unbundled system we adopt a rather general architectural model from. Our architectural model consists of components, connectors (between components) and a policy restricting the ways how components and connectors can be arranged/interacted. An architecture of a particular unbundled system is then defined by a number of (more or less) autonomous processing components, so-called services (or agents), which cooperate with each other.

In a monolithic active database environment, the only autonomous components are a number of clients and the active database manager. Architectures consisting of components and connectors can be described by means of ER-style diagrams, denoting components as rectangular boxes and connectors as diamond-shaped relationships. Four different connectors regulate the interaction among these components:

1) *Database access:* It allows clients to establish a session with the database manager, to start and end transactions, and to access or modify data items within the database. Thereby, the database manager synchronizes concurrent client accesses.
2) *Rule base modification*. Clients may modify the rule base e.g., adding/removing rules. External Event Detection and External Action Execution. To trigger a rule, clients may raise events, so-called external or abstract events, indicating some specific occurrence of interest. Furthermore, a rule may trigger an action which is to be executed by some client.

A first unbundling step is the separation of the active mechanisms from the DBMS. This enables the use of active functionality in different environments, e.g., with various existing commercial database systems. From a software engineering perspective, active capabilities have to be developed only once and can be re-used in different contexts. Active functionality offered by an activity service includes rule management and rule execution. Both are related to passive database functionality.

Rule management can exploit database services to store the rule base persistently. Rule execution requires the ability to detect events, to evaluate conditions, and to execute actions. The passive database manager is involved in rule execution as an important event source, to evaluate conditions that refer to database states, and execute actions modifying the database. Three new connectors regulate this interaction between the passive database manager and the activity service: Database Event Detection. This connector determines what kind of events the database manager produces and what kind of events the activity service subscribes to.

Database events are raised in the context of some database access; thereby, an access may raise several events and one event may depend on several accesses. Depending on event semantics and coupling mode the database event detection connector enforces that the activity service performs certain steps before the database manager may proceed with processing the access raising a certain event.

To evaluate conditions and to execute database actions that refer to database states, the activity service and the passive database manager have to cooperate. The activity service determines when evaluation of the database condition must be initiated and when an action has to be executed according to the rule execution model. Furthermore, it propagates information attached to an event occurrence. The database manager is responsible for the actual condition evaluation and action execution. These two connectors require database access capabilities as provided by the database access connector.

Moreover, they require a transaction service allowing database accesses to be performed as part or subtransaction of a transaction performed on behalf of some client. If the database manager requires that access commands are statically compiled before they are executed, the corresponding compilation is also performed via the condition evaluation or database action execution connector during a rule base modification. Furthermore, the activity service may also make direct use of the database access connector in order to store and manage rules persistently.

Active mechanisms are decomposed into two components which can be selected individually and configured and interconnected independently. For example, for different applications event detection may require different types of primitive and composite events, different event consumption modes, or different durations over which events are kept as a history. Rule execution may demand different application specific execution guidelines. Furthermore, the event detection and rule execution can now be used each on their own, independently from the complete active functionality. For example, we can provide separate event monitoring and production rule facilities. Two components responsible for the two new services, Event and Rule Service, and a new connector, the Event Signalling.

The Event Service records events, maintains a (persistent) event history consisting of all event occurrences and detects composite events. It is informed about the occurrence of primitive events via the event detection connectors, and it provides event information to condition evaluation and action execution using the appropriate connectors.

The Rule Service is responsible for the maintenance of the rule base and implements the rule execution cycle.

Event signalling is a connector between Event Service and Rule Service. The Rule Service subscribes to events which may trigger a rule. Events are signalled as soon as they are recorded in the event history. Furthermore, the Event and the Rule Service may also make direct use of the DB Access connector in order to store rules persistently, to search the rule base, and to retrieve rules.

To provide active functionality in a distributed, heterogeneous environment, we have to generalize the activity service. Thereby, active functionality is detached from the context of one particular database system. Our goal, however, is to use whenever possible the uniform active functionality as before, in particular, to keep a well-defined semantics.

The information resources which interact with the activity service are the passive database manager and clients acting as event sources or executing actions, In order to support a heterogeneous set of information resources, we have to generalize this interaction. Heterogeneity of information resources directly impacts the connectors for event detection, condition evaluation and action execution which link these resources to the activity service. There are two basic architectural options to support heterogeneity. Specific connectors can be provided for each individual resource, or, heterogeneity could be hidden by more general connectors. It is desirable to keep the activity service as independent as possible from the set of information resources required by a particular application, therefore, we favour the second option. The basic idea is to generalize connectors into more abstract contractors hiding a set of heterogeneous components.

Computer networks

A network consists essentially of two kinds of elements:

1) Network nodes which are the actual computing end systems, for example larger computer systems, personal workstations, terminals etc;
2) Connections between these along which data transmissions travel.

Network nodes can have a greater or lesser degree of autonomy in local processing power and ability to control the communication process. The connections can be implemented in various media, but in some way serve to switch data flows between these network nodes, to pass information from a source to a destination in the most appropriate way. As a first stage, networks can usefully be categorized by the type of switching which is used. There are three basic types of switching i) circuit switching, ii) message switching; iii) packet switching.

Circuit switching occurs when a physical link is made between the two network nodes for the duration of a session, along which the data can flow under the control of the end systems. The connection must be set up before the information exchange can begin, and released once the session is completed; in the interim, the circuit is only available to the two participants even though the channel may have spare capacity which is unused.

Message switching does not establish a physical connection, but relies on the network to deliver a message successfully once sent. The network is used as an intermediary: the source end system delivers the message to the network and then has no further involvement; the network will carry the message to its destination as a discrete process. The source end system is not aware of the details of this process, and does not work interactively with the destination end system.

Packet switching techniques take a more structured approach, dividing an individual message into separate 'packets', each of which can travel independently through the network. The network is responsible for the safe delivery of these packets, creating them from the message dispatched from the source end system at the point of entry to the network, and reassembling them into the original message at the point of exit for the destination end system. Since the network is dealing with smaller standard size packets in a predetermined way, a faster transmission rate can be achieved. The network is able to make its own decisions on routing, and can change these dynamically as traffic conditions change, with no apparent difference to the end user.

Network types concerns the geographical extent of coverage, and the size in terms of the total number of network nodes which can be feasibly connected. A general classification is to describe networks as either:

1) *Local Area Networks (LAN)*, which are limited to a single site or building, interconnecting nodes within a single organization;
2) *Wide Area Networks (WAN)*, which are not geographically limited in scope, and are capable of national- and global-level interconnections.

This distinction arises from the very different technologies from which each of these approaches have grown; however, these categories are beginning to break down, as local area networks become more powerful and can themselves be interlinked to form larger entities.

Metropolitan area networks, which exploit the new transmission media such as fibre optic cable, to build city-wide capabilities. Wide area networks can be usefully seen in two groups, distinguishing public and private systems:

— public telecommunications networks are international in scope, and accessible as a publicly available service;

— private data networks may also be on a national or international scale, but are intended for a distinct user group and not for general public access, although they are likely to make use of services offered by public telecommunications operators.

Each of these network types uses networking technologies which are most appropriate for their purposes. These may be quite unlike each other, employing different techniques, principles and protocols which are not easily compatible. Stemming from these different technologies, there are consequent differences in maximum data transmission rates, number of possible network connections, response times and overloading factors etc.

The degree of control which is placed within the network, and the location of this control also arises from these differences in approach. This may be characterized along a continuum, which offers at the extremes:

1) Centralized network, with a single main switch to which all nodes are connected, and through which they communicate with each other;
2) Decentralised peer-to-peer network, in which each node possesses the same status as any other, and can communicate with any other of its peers on an equal basis.

For large-and small-scale networks, there are various compromise points along this continuum where they can be placed; an inter-network can also be constructed using various different topological arrangements which are interconnected at specific gateways-links from one type to the other type.

Terminal networks

Terminal networks are perhaps the simplest form of computer network, consisting of a number of relatively unintelligent terminals, each of which is linked to the central computer system and not directly to other terminals. These two elements work in a masterslave relationship to each other, in that the central system has much more extensive control of the process than the terminal, even though this may in fact be a more powerful machine, such as a personal computer emulating a terminal. In such centralized systems, the connections between terminals and central computer are arranged in a star topology, with communications routed through the central switch; if this should fail the main communication channel is cut off.

Terminal networks are very commonly used in large organizations that wish to pursue a centralized information policy, holding data and information systems at a single main point and providing widespread access to this. There may be a high level of communication requirements for this arrangement, however, where speed of response is important; for example a lending desk terminal in a branch public library may be required to transmit loan information to a central database and check appropriate records in a very few seconds.

The growth in use of desktop and personal computers has had a significant influence on the development of centralized systems, swaying the balance of control more towards the end user. This has led to attempts at creating a greater integration and cohesion between information systems at an organisational level, linking the departmental/office information into the corporate database level.

Terminal emulation packages allow the end user to utilize a familiar desktop PC as a central terminal without the need to switch equipment, and increasingly to use the computing power of the PC to improve screen presentation rather than simply emulating a dumb terminal. This provides the user with a more familiar and 'friendly' workspace environment. Developments in software compatibility are integrating the standard software packages in use on both central and local systems for mainstream applications such as databases.

Local Area Networks (LAN)

A Local Area Network (LAN) is a means of linking together a collection of computer-based devices, within a limited geographical area, on a more or less equal basis. This equality makes the LAN radically different from a terminal-based network, because each of the computer systems connected is an independent self-governing entity working in a co-operative relationship.

LAN fall principally into two types:

1) proprietary networks which are used to interconnect a number of computers and their peripherals of the same type, for example a network of IBMPC or Macintosh personal computers;
2) standards-based networks which can interlink computer systems and devices whatever their type and specification, through the use of common network technology.

For both types of LAN, every device connected to the network must communicate through a uniform hardware interface and software protocol to achieve compatibility.

Standardization of the communication process is therefore very important to the concept of local area networks. Since no one method of operation would be suitable for all possible needs, a number of alternative standards exist, reflected in the different types of LAN available.

LAN will typically be provided to support:

- resource sharing of expensive hardware resources, for example a colour printer, a high-speed modem, or a CD-ROM drive accessible to all nodes on the network;
- resource sharing of software and access to specialized facilities;
- file transfer and access to support the sharing of information between different users, and to provide wider access to central information while ensuring consistency by maintaining a single copy of the data;
- messaging and conferencing to enhance organizational communications and co-operative working;

The most commonly found use of proprietary local area networks is to interconnect IBM-PCs within a single site or building. There are broadly two types of PC-based local area network, distinguished by the operating system by which they are managed.

1) In peer-to-peer PC networks all the network nodes interrelate as equals, able to call on the services of other nodes and to offer their own at all times. This is an intuitively natural way of sharing resources, and is cheap and effective to implement for small workgroups.
2) In server-based PC networks, one or more network nodes act as a provider of services for the other client

nodes. Clients can only call on the services of a server node, which is dedicated to this purpose; there are three main types of server: a file server dispenses data and program files across the network, either in whole or in part; a print server drives the printing devices and manages the print queues; and a communications server controls external links, such as facsimile machines, or modems.

Standards-based LANs

There are two industry wide standards for more broadly based local area networks, known as Ethernet and Token Ring.

Ethernet is the most widely installed local area network at the current time. This describes a specification for a LAN rather than an actual product; there are many implementations of Ethernet from a range of suppliers. Ethernet aims to provide a high-speed network which gives all nodes stable and equal access to the network, in such a way as to prevent individual stations interfering with each other; and allowing a transmission to be addressed to individual nodes, a group of nodes, or the whole network community. The intention is that all Ethernet installations are compatible with each other, since they use the same set of protocols. The stations on an Ethernet are each linked directly to a main transmission channel in a bus topology. Stations may not transmit at the same time, but must wait for the channel to be free before sending; transmissions are broadcast to all nodes on the network, but only utilized by those stations to which the message is addressed.

There is a mechanism for the detection of collisions when stations broadcast together, which requires a station to rebroadcast after a random interval. Thus all stations are in contention for the channel and cannot be guaranteed a fixed rate of access.

Ethernet suits the typical office environment where user activity follows this pattern. Ethernet has a relatively high data rate of up to 10 Megabits per second (Mbps) and is able to support large data file transfers without undue disruption to the user. It does not, however, support voice and video transmission, because the nature of the access medium cannot guarantee the continuity necessary for voice or moving image. There are technical limitations to the size of Ethernet networks, both in length of cabling and in the amount of data traffic which can be supported.

Token ring network takes a different approach and as the form chosen by IBM for its own local area network has become more popular. The nodes are connected in a ring configuration, with each node receiving information from its 'upstream' neighbour and re-transmitting it to its nearest 'downstream' neighhour Each node, either originates its own transmission, passes on the data exactly as is received, or removes the data which is addressed to itself. To control transmission collisions, each node has the opportunity to transmit in turn, governed by the passing of an electronic 'token' around the ring. The Token Ring thus provides for both an egalitarian 'round robin' access, and multiple priority levels for urgent messages. The method is self-governing to quite a high degree, and able to react dynamically to changing conditions.

International standards development for local area networks has been co-ordinated by the Institute of Electrical and Electronic Engineers (IEEE) in the United States. This work is intended to develop a framework within which the major types of LAN can be encompassed rather than to specify one single standard for all requirements. The standards are known by numerical, rather than product names, and cover both Ethernet and Token Ring style networks.

1) The 802.3 standard defines a broadcast bus-based network, which is effectively the same as the Ethernet type.
2) The 802.5 standard defines a token passing ring network similar to the IBM Token Ring local area network.
3) The 802.4 standard describes a token passing bus network, which combines features of the first two types.
4) The 802.6 standard defines a high-speed broadband network, better known as a metropolitan area network.

As the local area network grows in size and complexity the amount of traffic increases, overloading the network and degrading response time and reliability. A number of devices have emerged to support both the partitioning of over-large LANs and the desirable interlinking of others.

1) A repeater carries messages between two sections of a single network, allowing it to be extended beyond the maximum cable limit.
2) A bridge is a station which is connected to two networks, through which the two LANs can exchange data frames. The networks must be using the same protocols so that they look like one logical network, but only traffic destined for nodes on the other network will pass over.
3) A router is a device for sending data frames between two dissimilar LANs, since the router can deal with both network types.
4) A gateway links a local area network to a different networking environment altogether, such as a wide area network.

The development of standards for local area networks is continuing with the emergence of newer technology and physical media. In particular, the use of fibre optics is having a substantial impact, potentially opening up the geographic and bandwidth limitations in this field to such an extent that distinctions between local and wide area networks are becoming less meaningful.

Wide Area Networks (WAN)

The Wide Area Networks (WAN) are constructed from point-to-point links between different nodes on a store and forward basis. Data transmission are passed from one node to the next, *en route,* with each node making its own routing decision based on matching the information which it holds in a routing table with the destination address on the data packet, and in the context of current network traffic conditions. Control and management of the network is therefore distributed throughout, and not located in any single central point.

The network can be extended by adding new connections between nodes and making appropriate updates to routing tables. There are likely to be alternative routes between nodes which can be used at different times. The relaying of data between nodes in this way requires the use of protocols to ensure correct delivery and protect against the corruption of transmissions *en route.* The protocols normally operate both within the end systems and within the network relay nodes themselves. There are several alternative protocols suites which may be in use; however, all nodes on the network must be running the same protocols to communicate successfully, since this is the glue which binds the disparate systems together. As an indication, some common wide area protocols are:

1) The X.25 protocols which have been developed for public telecommunications, and ensure international

compatibility in this area; these have also been adopted in some private networks;

2) The TCP/IP protocol suite, widely used in private networks and in the academic and research world.

Private data networks

The Private data networks can be constructed from a number of different elements, as appropriate to requirements and conditions. They may be national or international in scope, and involve the co-ordination of several different network operators and administrations, using elements from:

1) Public telecommunications operators, in the form of leased data lines or use of the public data network;

2) Private network operators, including commercial long-haul network operators and satellite communications suppliers; independent local or wider scale data lines directly owned.

The leasing of dedicated digital data lines is an alternative to use of the public data network. These are private circuits, provided as a carrier by the telecommunications authority, but under the control of the organisation which is renting the line. Leased lines are point to point connections, permanently linking one site with another, rather than dynamically switchable channels. Since they are leased at a fixed annual rate, the greater the use made of the line the more efficient it becomes. Multiple rented private circuits are used by large organizations to create private networks, linking remote sites together on a point-to-point basis, or providing a high-speed network backbone for a high volume of traffic between main sites.

In the United Kingdom BT provide a range of leased circuits with varying data carrying capacities:

1) *Kilostream and Kilostream N lines* provide bulk data transmission at rates from 64 Kbps up to about 1 Megabit per second (Mbps);
2) *Megastream lines* provide higher speeds of up to 2 Mbps;
3) *Satstream* utilizes satellite capacity to offer point-to-multi-point connections over a wide geographical area.

The use of leased lines is a more secure and flexible option for the larger organization, which is able to deploy the systems and protocols which it finds most suitable, rather than having to conform to those used in public systems.

Telecommunications networks

There are three types of telecommunications network presently available for use for computer-based information networking; each of these represents a phase of the developmental efforts to improve services over several decades, using quite different technology and approaches.

Public Switched Telephone Networks (PSTN)

The Public Switched Telephone Networks (PSTN) are extensive networks of cabling reaching into almost all inhabited parts of developed countries, and providing international connections worldwide. This made it attractive as an immediately available option for computer networking in its early stages.

The PSTN network is designed for voice communication, and therefore requires the use of an interfacing data communication device, usually a modem, to be used. The network makes use of circuit switching technology for the same reason, and is a rather noisy and unreliable channel, prone to errors and mis-connection. It is poorly suited to fast and reliable data transfer and depends on the end systems alone to maintain quality through the use of suitable protocols. The PSTN makes inefficient use of the available carrying capacity because the circuit is idle when neither end system is transmitting but cannot be used by waiting nodes. Since a switched phone line is charged on a time and distance basis, regardless of the amount of traffic, it is not ideal for inter-computer communication over long distances.

Public data networks

The public data networks have been constructed specifically for the transmission of computer information, and cannot be used for voice conversations. They provide fast and reliable data transfer, more flexibility and international communications at a reasonable cost, since they are charged for by the amount of data transferred. The advantages of packet switching are the following:

1) There is no need for a direct physical connection between sender and receiver;
2) Information from different calls can then be interleaved on the network channels to make maximum use of the available bandwidth;
3) The user, therefore, pays only for information actually transmitted, rather than for elapsed time regardless of the transfer activity;
4) Standard use of communication protocols facilitates the inter-connection of equipment from different manufacturers, operating at different data rates.

The X.25 protocol set is the standard for public packet switched networks. This is an open standard which is available for end systems as well as internally to the network. Public data networks are mostly managed on a national basis with international connections between them, and so X.25 forms something approaching a global standard in this area. There are, however, two versions of the X.25 protocol; the latest 1988 version is not used by all public telecommunications operators. The public data network is essentially a store and forward network which operates at speeds fast enough to give the impression of a direct connection to the end user. The network can be considered as an opaque entity—a 'cloud'—by the end systems which need only to specify an address for the remote end system which is being called, having no concern with the details of routing. The network 'cloud'- consists of a collection of packet switching exchanges (PSEs) which forward packets through the high-speed network from the local exchange to the destination PSE.

Integrated Services Digital Networks (ISDN)

Development of public data networks for digital communications led to the existence of different networks for different purposes-one for voice, one for data-and requiring organizations using these systems to connect to both. A duplication of networks is undesirable, and also works against the integration of information types, for instance the co-ordination of voice, data, and image, which is increasingly needed to support multimedia information networking.

Two development programmes in the telecommunications infrastructure provided the platform for the development of integrated services digital networks:

1) The digitization of the trunk network lines, the main arteries used by the network operator.
2) The replacement of electromechanical local telephone exchanges by digital switches, such as System X and System Y.

The ISDN aims to build a public network providing end-to-end digital connectivity which is capable of supporting a range of digital devices and services, both voice and non-voice, on the same basis. This allows users to send and receive data, text and image from computer systems as well as offering an enhanced telephone service. This is achieved over a single ISDN connection, so that one network may be used for all applications, at the same time as providing higher transmission speeds.

The ISDN approach is to enable the existing local telephone circuitry-the 'local loop-to carry digital signals through the use of specialized equipment and adapters, rather than a wholesale and long-term replacement programme. This requires the installation of suitable network connections in the customer premises, which acts as the interface to the digital network. Despite this fully digital transmission system it is still not possible to connect all computer equipment directly to the network, unless the equipment is designed or adapted to work-with the ISDN system.

Access to the ISDN network is available at two different capacity rates, known as basic rate and primary rate. The access rate refers to the number of logical channels which are available on a single ISDN connection. Each of these channels constitutes a circuit which is independently usable by different information media, and can be switched to different destination points.

The basic access rate provides two bearer channels and one data channel, and for this reason is otherwise known as 213 + D. Each of the bearer channels can simultaneously carry a separate information stream, at a transfer rate of 64 Kbps.

The primary access rate gives a higher number of bearer channels, although the exact number is variable between countries—the United Kingdom, Europe and Australia supply 30 bearer channels to the user in one

ISDN connection; in the United States, Japan and South East Asia 23 channels are used. 30B + D gives an overall data rate of some 2 Mbps and necessitates the use of extra equipment at the subscriber premises to manage the multiple channels. Potential benefits from the use of ISDN are the following:

1) All 30 ISDN connections can be switched to different locations;
2) Clearer calls and more reliable data transfers, with less line noise;
3) The ability to send two information streams to the same locations, to support remote co-operative working; for example, two users might discuss over the phone the contents of a computer screen which can be transferred between their terminals;
4) Enabling domestic services, such as home shopping and banking, online database access, security, and control services for the home;
5) Feasible desktop videoconferencing;
6) Providing a better infrastructure for teleworking, for example by providing a gateway to an office LAN for home-based workers.

Frame Relay Networks (FRN)

The Frame Relay Networks (FRN) technologies are in development which may threaten to overwhelm ISDN before its full potential is reached. These involve the use of high-speed packet switching on high bandwidth networks which will offer much greater information transmission capabilities than the present public data networks. Frame relay networks are made possible by use of less noisy transmission media, such as fibre optic cable, in the network infrastructure, exploiting this greater reliability to simplify the protocols necessary and thus speed up the transmission process.

Integrated Broadband Networks (IBN)

The Integrated Broadband Networks (IBN) are sometimes referred to as broadband ISDN (B-ISDN) systems and will also exploit the advantages of fibre optic to offer a dramatically enhanced communication facility, far more powerful than exists at present and able to deliver a wider range of services more effectively. The intention of developing integrated broadband communications systems is to provide a single network for all services, which can be flexibly and dynamically configured according to individual circumstances and priorities.

Digital networks allow both data, voice and image to be sent along the same connection, but these information types have different desirable transmission characteristics. Data and text require a high degree of accuracy, since the quality of the received information is more easily affected by corruption, but are more tolerant of short transmission delays. Voice and the moving image, on the other hand, are more tolerant of errors since these can be interpreted by human interpretation, but are more susceptible to variations in transmission delays.

Existing or narrowband ISDN circuits do not have a high degree of flexibility in adjusting to these varying demands: for instance, a voice call does not use the full capacity of a 64 Kbps channel, but the spare cannot be freed up for use by others during a session. Broadband networks aim to overcome such problems by using a universal fast packet switching technique for all information streams, and allocating bandwidth on demand rather than relying on fixed bandwidth channels. Two rates have been proposed for B-ISDN: a basic rate service with a digital access rate of 155 Mbps, and a primary rate service at 622 Mbps, although the full specifications for these have yet to be defined.

A technique known as the Asynchronous Transfer Mode (ATM) is used to transfer the data. This divides the data stream into cells, which are smaller than X.25 packets in size, and can travel through the network at a faster rate. Since the channel is more reliable, quality control is performed at each end of the link and not by each intermediate network switch as well. This ATM approach is particularly suitable for information activity which is inherently 'bursty' in nature. For example, a service would be able to ensure fast delivery of high definition images, and then free the channel for other use during the reading and thinking time in which the user is not generating any network activity. This will allow the development of true multimedia information services.

Developments in the wider networking field are increasing aiming to deliver faster data transfer rates, on integrated networks which make no distinction between information types. As the amount of electronic information available across networks grows exponentially, and the sophistication of end-user computing equipment encourages the sharing of information in more intensive forms, network infrastructures respond with the ability to communicate sophisticated forms fast enough to make actual use of the network transparent to the user. At the organizational level, local area networks are also undergoing technical developments which increase their speed and potential for the delivery of more sophisticated and high-powered information applications.

Future of networks

Computer networks are poised on the brink of a new upsurge in capacity, breadth of connectivity and service development. Current developments in public ISDN networks, and their predicted supersession by integrated broadband communications, and private network developments such as SuperJANET in the UK and the proposed educational National Research and Education Network in the United States, and the continuing integration of commercial and industrial networking all promise the development of new forms of information service and transfer. The convergence which has been occurring for many years between computing and telecommunications is now drawing together with the field of broadcasting communications as well. The digitization of the various forms of networkable information, and the technical harmonization of the various networks along which the information forms are carried is continually eroding the distinction between computer and telephone networks, cable television networks, and satellite broadcasting.

A major development in the short- to medium-term future will be a substantial growth in multimedia telecommunications in one form or another. In this way, multimedia information networks will correspond more closely to the experience of communication and information interchange in everyday life, with a flexible mix of sound, picture, and words.

A major preoccupation of national governments and regional associations is to build the infrastructure for these developments as quickly as possible. In the United States, for example, in an attempt to accelerate the extension of fibre optic cabling to the home and workplace on a massive scale, the Federal Communications Commission (FCC) decided in 1992 to allow the regional Bell holding companies to transmit video programmes over their telecommunications lines, in competition with the cable television companies. This attempt to create a communications infrastructure for the next decade is seen by many Americans as crucial to the continued economic dominance of the United States. The FCC, for example, places much weight on multimedia devices such as high definition television (HDTV), a digital two-way interactive television set, as the vehicle for this information expansion, aiming at a 15-year deadline for complete HDTV conversion.

Existence of a technology, however, does not always guarantee its success. It is worth remembering that the Picture Phone was launched by AT&T at the World Fair of 1964. This was a first example of the videophone" in 1992, almost 30 years later, British Telecom launched a low-cost consumer videophone, which can be connected directly to the normal telephone socket; this has yet to make any substantial impact in the marketplace. A development which is likely to be of more significance, though, is the planned availability of audiovisual workstations based on the standard PC. Such a device will make the full integration of data and voice networks within the workplace a reality, and will open up a wider market for multimedia information services. Many of these exist in prototype form within the existing infrastructure, Multimedia electronic mail, for example, is now possible even in a limited text-based medium such as the internet.

The Multimedia Information Mail Extensions (MIME) to the standard Internet mail protocol permit the inclusion of still images, group III fax images, compressed full motion video, and multipart playback sequences of mixed information types. Desktop videoconferencing, the ability to conduct meetings with a geographically remote person each at their own desk, has been established as a feasible communications technology, although so far finding only a niche rather than global market.

The experience of this videoconferencing raises some key issues since it is clear that, as with most other information technologies, the technical issues are much less important than the social and organisational ones. Technical advances which have made the idea more feasible include the emergence of high bandwidth ISDN networks, video compression techniques, accepted standards, and powerful graphics-based workstations. The degree of success in implementing this technology is determined rather by the extent to which it supports the way people work. The involves an understanding of the communications patterns between individuals and groups, and of their information needs and the uses to which information is put; of the way in which contacts with individuals and formal information sources assists the innovative process, and an appreciation of the interdependent balance between formal and informal communication.

Technology has often been used to support formal communication patterns, rather than the informal, and sometimes is intended to replace rather than support either. Multimedia communications systems cannot replace face-to-face contact any more than the telephone (although a similar argument was made against the telephone at its introduction). Thoughtful design may, however, be used to appropriately support existing human communication patterns.

The Cruiser videoconferencing system designed by Bellcore, for example, uses the metaphor of a 'virtual hallway'—floor plan representing the groups of participants—along which a user may navigate, 'cruise' and interact with others in the process. For multimedia multi-user systems such as this, the interface must include some form of social protocol which enables decisions about the nature and style of desired interaction to be taken. Many issues which will effectively delineate the shape of multimedia networking in the future remain as yet poorly understood and little explored. In some areas, however, there is more immediacy on concerns which are being raised by the substantial growth in network traffic and users, and the potential changes which can be perceived in the near future.

Growing importance of digital information and its availability over networks which demand physical and technical access create barriers which are increasingly insurmountable for many groups of potential users. While there is no space here to discuss the social role of information systems, there are a few examples of attempts to bypass these barriers in recent developments. The Cleveland FreeNet experiment, for example, is an attempt to increase access to Internet information to a wider audience. The vast amounts of information, and the worldwide nature of the Internet, also bring to the fore issues of intellectual property and copyright surrounding electronic information.

Much of the information held on this network is freely available, as long as it is used for non-commercial purposes. The subsequent use of information taken from computer networks cannot be controlled, however, once it has been downloaded from the original source. It may appear in many diverse guises, be re-partitioned, amalgamated, and reused, taking on a life of its own. Print-based copyright legislation does not translate easily to the electronic environment. A feature of the legislation to found the advanced NREN network requires the provision of charging mechanisms to be put in place, suggesting a trend towards more control over use and users. The characteristics which make electronic information difficult to define and 'freeze' at one point in time also raise questions on the nature of bibliographic control and mapping of information resources.

Electronic documents and journals which can be updated immediately, replacing the original copy, are difficult to define as a bibliographic entity which has a declared and fixed content, which can be cited for later use. The identification of various versions of a logical item becomes a complex task, as does preservation and archiving as a permanent record of publication. These problems also redound upon ethical issues involving the quality and accuracy of the document content. Electronic documents may easily be changed, or 'falsified' with changing intellectual fashions in a way that print fixed at one point in time cannot.

The unstructured and fluid process which allows a network user to make information available without recourse to formal publisher or refereeing process has great advantages in stimulating an innovative and creative dialectic, but at the cost of a large proportion of false, misleading, or incorrect information which must also be sorted through and rejected. Whilst the research community, in which much of this type of activity takes place at present, has evolved a fairly sophisticated code of practical ethics for network co-operation and exchange, it is doubtful that this will survive a broadening of access and the introduction of commercial interests.

The increasing ubiquity of the networking environment is raising questions about the relative responsibilities of those involved in the information transfer process. Traditionally, this process could be described in terms of five distinct roles: the information provider, who provides the original source material; the information host, who makes it available and accessible, 'publishing' in a print or electronic sense; the carrier or distributor, providing a channel for the information; the intermediary, traditional role for the information service professional; and the information user, the final consumer. This model has long ago begun to break down when applied to the networking environment. The information provider is often the same as the information host; the common carrier, the telecommunications authority, provides information services in its own right; and the information user more often wishes to find and retrieve the information directly.

Many people have begun to question the role of the publisher in the electronic environment: since the author can mount a document in its electronic form on a local computer and the network facilities act as a distribution mechanism, it becomes harder to gauge the function of a traditional publisher. Although this is clearly not appropriate for many types of publishing, in some areas it is possible to see advantages. For instance, the traditional venue for reporting research has been as a journal article in some summarized form; network publishing would allow a reader to optionally download original datasets and intermediate analysis, as well as authorial commentary, directly and without a time delay.

Information user and provider potentially have a much more direct and interactive relationship, possibly to the extent that the information exchange cannot be completely separated from the communication process itself. This raises a question mark against the received role of the intermediary, as a filter between originator, distributor, and recipient.

As the growth in electronic information begins to demand a new philosophy of the nature and function of information so also the activities of the information professional must, in this setting at least, change and adapt. No longer able to adopt a custodial role in managing and organizing the materials and artefacts of information, the librarian or information scientist must adopt a facilitating strategy, aimed at creating the conditions for a user to negotiate the information sphere successfully.

5

Globalisation: Information, Media and Opportunities

Globalisation indicating the ways through the modern society is increasingly connected by the networks and their products that operate on a world scale. The new information and communication technologies have shrunk the planet to a global village, and made information available to a growing number of people on every continent. It is today the basis and criterion for the analysis and interpretation of international law relating to the media. The question, however, is how to apply the new information and communication technologies effectively to development and how to use them in order to bridge the gap between the rich and the excluded, between nations and within those self-same nations.

Freedom of information

During the second World War, the international community became alive to the way in which people's attitudes and awareness were affected by total control of the media. In 1941, President Roosevelt placed freedom of speech and expression everywhere in the world in the front rank of the 'four freedoms'. Defending freedom of information naturally became one of the objectives of all efforts to rebuild the international system. In 1945, the Chapultepec Act, adopted by the Inter-American

Conference on problems of war and peace proclaimed for the first time 'the freedom of international information flows'. In 1946, the UN recalled in its resolution 59 that 'freedom of information is a fundamental human right and is the touchstone of all the freedoms to which the United Nations is consecrated' On 10 December 1948, freedom of information was enshrined in the Universal Declaration of Human Rights, whose Article 19 is the most categorical expression thereof.

> 'Everyone has the right to freedom of opinion and expression; this right includes freedom... to seek, receive and impart information and ideas through any media and regardless of frontiers.

The Munich Declaration adopted by representatives of journalists unions, proclaimed that the right to information, to freedom of expression and criticism, is one of the fundamental rights of man. The ten principles of the Charter for a Free Press were adopted in London in 1987 by journalists representing thirty-four countries and the main organizations working in the field of press freedom. The charter was signed by the World Press Freedom Committee (WPFC), the International Federation of Newspaper Publishers (FIEJ), the International Press Institute (IPI), the Inter-American Press Association (IAPA), the North American National Broadcasters Association (NANBA) and the International Federation of the Periodical Press (FIPP).

Information flows remain largely to the advantage of the North; but an increasing number of developing countries are becoming in turn producers, broadcasters and operators on a regional and even a worldwide scale. The smaller countries of the North are themselves becoming ever more dependent upon the output of the major international corporations in regard both to information and to entertainment and fiction films.

In the industrialized countries, while access to the media poses no special problems aside from financial constraints, the growing dependence of the small countries on the major international suppliers of texts, images and data has become an extremely worrying factor. As regards the least developed countries, their situation has worsened still further in that many have become still more impoverished, and have been left on the fringe of technological progress.

The General Conference of UNESCO adopted, at its twenty-fifth session in November 1989, a new communication strategy aimed at meeting the needs of the burgeoning democracies and the developing countries alike. Its goals were:

1) Encouraging the free flow of information, at international as well as national level.
2) Promoting the wider and better balanced dissemination of information, without any obstacle to freedom of expression.
3) Developing all the appropriate means of strengthening communication capacities in the developing countries in order to increase their participation in the communication process.

UNESCO pledged to promote both freedom of expression, the cornerstone of the human rights edifice, and press freedom, itself a key component of all democratic societies. It provides assistance to intergovernmental and non-governmental organizations whose mission it is to defend these fundamental freedoms, while at the same time preserving and developing its own means of action.

Second objective of the 'new communication strategy' takes up one of the ultimate goals of NWICO, with a single difference that it is no longer possible to curb or to prevent the free flow of information on the pretext that its dissemination is unbalanced. Such an argument had in fact frequently been put forward by authoritarian and totalitarian regimes, in order to justify censorship of the international news agencies, to ban the distribution of foreign newspapers on national territory and to jam electronic media broadcasts transmitted from abroad.

The third objective of UNESCO's 'new information strategy', is to develop communication capacities in the developing countries. When the General Conference of UNESCO adopted its 'new communication strategy' in November 1989, the representatives of the developing countries, somewhat at a loss after finding themselves dropped by their traditional partners among the Communist states of Eastern and Central Europe, had greatly hoped that industrialized countries of the North, having obtained satisfaction on the free flow of information issue, would do their utmost substantially to increase their financial support for the development of communication, in particular for International Programme for the Development of Communication (IPDC).

The media have played a key role in several countries in bringing about the democratic progress recorded throughout the world during the 1980s. Their ability to transmit, continuously and in real time, current national and international news has had the effect of both driving events along and speeding them up.

In most democracies, the press is perceived as both an outward sign and a guarantee of democracy. Regarded empirically as the fourth estate, it ensures that democracy functions properly, condemns abuses and clarifies the options available. Pursuing these aims journalists enjoy certain professional rights that are supposed to guarantee their editorial independence *vis-a-vis* both the public authorities and their employer.

In practice, however, many media professional regularly denounce the restrictions which undermine their independence—clear proof that the struggle for press independence is never over in democratic countries, even if it has lost much of its intensity. Journalists are concerned by the curbs placed by many governments upon the free flow of information. Access to public information sources, which is a precondition for ensuring that citizens are kept properly informed, is often limited if not deliberately restricted. In most cases, states stir impose strict regulations.

The obligation imposed in certain cases upon journalists to reveal confidential information which they alone possess, the common tendency to confuse secrets that could jeopardize the interests of states with those that would simply harm political administrations, and the repeated attempts to thwart journalists' investigative missions are all, generally speaking, detrimental to the citizen's right to information and, hence, to the public interest as a whole. Furthermore, media professionals consider that they are not safe from threats and intimidation.

Infringements of, and obstructions to, freedom of information increasingly take the form of a whole range of obstacles placed in the way of journalists: these include house searches, indictments, the forced suspension of publication, violence and even murder. The use and the interpretation made of libel actions, of requests to exercise the right of reply, of public order disturbances, provisional or emergency measures, and actions for damages are usually governed by the circumstances of the moment. The enforcement of these restrictions, which are moreover considered to be outmoded by the profession, generates a climate of insecurity and suspicion that weighs heavily upon freedom of information.

In the print media field, trials relating to the disclosure of documents deemed to be secret or confidential are becoming increasingly common, and are usually aimed at smaller newspapers, whose limited financial resources reduce their ability to defend themselves or to pay the fines and damages awarded against them. Media professionals consider that these judgements represent a direct threat to freedom of information and investigative journalism, understood as the concern to go beyond official sources in the search for information. They face journalists with an unacceptable dilemma, since they are liable to be convicted of libel if they publish confidential information without providing proof of the facts revealed, and convicted for possession of stolen property if they hold and publish the evidence confirming their allegations.

The Munich Declaration emphasizes the right to information by affirming that journalists may claim free access to all information sources and the right freely to investigate all events that affect public life. It adds that the secrecy of public or private affairs cannot in such cases be adduced as justification for denying journalists these rights save in exceptional circumstances and on clearly stated grounds. This trend towards freeing access to information sources from legal impediments has been enshrined, in most states of the United States of America, in the so-called shield laws', which shield journalists against being forced to give testimony. It has also been regularly reaffirmed by regional and international courts of justice. In countries in transition, acceptance of the principle of a press that is free, independent and openly critical of all the authorities is a relatively recent phenomenon.

Majority of broadcasting networks are still state monopolies subject to strict controls. In countries with authoritarian or totalitarian regimes, the prevailing ideology leaves but little room for pluralism. The main dailies and weeklies are controlled, subsidized and administered by the state. Likewise, the coexistence of several newspapers or television channels does not necessarily constitute evidence of pluralism, in particular when their proprietors are close to the establishment. In such contexts, the public, the target audience of these media, is self-evidently not in a position to forge an enlightened and unbiased opinion of its own. Censorship may take a variety of forms, depending on whether it is practised officially or unofficially. The ban upon satellite dishes in force in many countries, and the controls exercised on access to electronic media and the Internet, deprive citizens of alternative information sources. Moreover, various administrative measures may prove just as effective as overt censorship. These range from restrictions upon, for example, the use of newsprint and other professional materials and hardware, to more direct forms of interference: control over the printing at newspapers, monopoly on the importation of paper, right of scrutiny of newspaper circulation figures, control over the award of advertising contracts, exorbitant taxation of certain publications, etc.

In order to explain the strengthening of their control over the print and broadcast media, and even to justify the censoring of news-reporting that does not serve their interests, the authorities generally put forward the same reasons: imperatives bound up with issues of national security and public order. Thus many countries grappling with terrorism and outbreaks of irrational violence have adopted public order measures that have inevitably eroded press freedom severely. Freedom of information may be limited by other entities than governments. In some countries, extremist groups resort to force in order to prevent families from picking up foreign television channels that spread values alien to their own. Others launch fat was against intellectuals, artists and journalists. Others still go to the extreme of murdering journalists and other media professionals. In this regard it should be pointed out that, in almost every case, inquiries into crimes committed against journalists have come to nothing, and neither those who carried them out nor those who ordered and paid for the killings have ever appeared before the courts.

This initiative for International Freedom of Expression Exchange Network (IFEX) was launched by several professional and non-govern mental organizations concerned to pool information more effectively and to enhance the impact of their interventions, which set up an electronic alert and coordination network to react whenever freedom of information is threatened. Operational since September 1992, the network is run by the Canadian Committee to Protect Journalists, in Toronto, with the support of UNESCO and its IPDC.

The IFEX Network today has twenty-seven members, including the major organizations. The network, which is a vitally important point of contact for all journalists and professional media organizations, comprised in May 1997 more than 300 subscribers in eighty countries, 160 of them located in the developing countries. In five years, the network has made it possible not only to improve the gathering, production and disorientation of news and information on topics relating to press freedom on an international scale but also to strengthen the development of South-South exchanges, and, finally, to set up a veritable system of alert and solidarity among all the protagonists: 1,600 alerts are issued each year, as well as a weekly press release in three languages. Joint campaigns are also conducted. A data bank has been created on the Internet which makes available the information gathered by IFEX on a World Wide Web server (http:Hwww.ifex.org).

Throughout the world, there exist dozens of conflict situations in which the media perform a more traditional but no less essential role as 'witnesses' Their supposed mission being to report everything that occurs in these regions and to reveal violations of the fundamental principles of humanity, the media are in a position to keep international public opinion informed and to alert it to the most horrendous situations. The journalist then becomes, as it were, a torch-bearer of democracy by reporting on what he or she has seen and learned in order to supply the citizen's basic need for information.

In situations of armed conflict, the journalist's job is a difficult and dangerous one opposition groups and civil and military authorities alike generally find it in their interest to conceal certain compromising realities. Some do not their hesitate to take appropriate steps in order to curb the activities of reporters. Harassment, threats and even murder are unfortunately becoming increasingly common in dealings with journalists who get in the way too much.

Media globalisation

This section describes some of the cross-border TV channels, illustrating one form of communication globalisation.

Cross-border TV channels

Development in cross-border TV stations accelerated powerfully at the end of the 1980s. Some are privately owned general-interest channels (Super Channel, Star TV) or public service systems (TV5, BBC World Service), while others are specialized in newscasting (CNN, Euronews, etc.), sport (Eurosport, Screensport, etc.), leisure (Disney Channel) or music programmes (MTV, MCM). They reach millions of homes around the world via cable networks or via collective or individual reception of satellite signals. In order to overcome language obstacles and increase their audience, cross-border stations are investing increasingly in national-language programmes (CNN, NBC, Star TV) or multiplex sound channels enabling televiewers to choose among several languages (Eurosport, Euronews). As a rule, TV stations are basically financed by revenue from commercials on the domestic market but are increasingly likely to target the international scene. In addition to commercials, some channels (CNN, Star TV) obtain a growing share of their revenue from pay-per-view systems via cable TV networks, as well as from hotel and individual subscribers. The success of cross-border television is due to a series of factors that are basically technological in nature: the boom in satellites, the proliferation of installed bases of dish antennae over vast regions of the world, progress in the miniaturization of TV control rooms, cameras and small-scale transmission stations which together have done away with distance and time.

Cable News Network (CNN)

Cable News Network (CNN) is the channel which best embodies the instant, global, worldwide status of television. The channel today can reach every region around the world via a network of satellites covering the whole planet. The aim to serve an international audience means that it repeats part of its newscasts every twenty-four hours to provide televiewers worldwide with a panorama of the main news at any time, hence the importance of CNN international, the version of the channel's news bulletin tailored for international audiences. It combines the international programme of

CNN and televised newscasts from Headline News, the other non-stop news channel of the Turner empire that telecasts a summary of the day's events every half-hour. The channel operators have announced plans for alternative cultural and language versions, aimed in particular at the Arab, Indian, Japanese and Russian markets.

BBC World Service

The BBC World Service is a subsidiary of the BBC, covers practically all five continents. It broadcasts a non-stop news programme twenty-four hours a day. To cover its operating costs it receives neither licence fees nor state subsidies and strives to balance its accounts through sales. In addition to its newscasts every hour, the BBC World Service adds news magazines and the best documentaries produced by the BBC. In recent years, it has improved its coverage through partnership agreements with regional or local channels such as the South African pay-TV network M-Net, and American and Japanese channels. While the BBC World Service seems to be the main rival for CNN, other news channels with specific linguistic or regional viewpoints are joining the throng.

Euronews

Euronews covers all of Europe, including the central and eastern regions, as far as the Near and Middle East. Televiewers have access to programmes broadcast non-stop twenty-four hours a day on a separate frequency for each of the six languages available: Arabic, English, French, German, Italian and Spanish. The originality of the channel is that the news bulletins are image-only telecasts, with voice-over journalists simply commentating on the pictures, reports and magazines provided by members of the European Radio-Television Union (UER). According to its proponents, by presenting a coverage of regional and world current events from a European point of view and in six different languages, Euronews can claim to be the European equivalent of the American channel CNN.

After starting out as a small programming stream in Hong Kong, Star TV has grown to seven channels and is now the largest network in the Asia-Pacific region. It covers practically all of Asia, with a perimeter that includes Australia, China, Japan, Pakistan and even the Near and Middle East. The network includes news, sport and music channels, and has seen spectacular growth, particularly in South-East Asia and in India. In Latin America, the company intends to launch a stream of 142 channels, telecast in Spanish and Portuguese. After consolidating its presence in Asia, the operator intends to target the Japanese market in 1997 by going on-air with Superbird C, a stream of a hundred specialized theme channels. The company also intends to penetrate the African and Indian markets with the forthcoming launches of Direct TV India and Direct TV Africa.

The French-language channel TV5 is also battling to gain planetary coverage by using four satellites: Eutelsat II-FI to cover the whole of the region from Helsinki to Casablanca, Statsionar 12 for the whole of the African continent, Anik El for North America and finally PanAmSati to reach Latin America and the Caribbean. Since its start-up in January 1984, TV5 has operated continually in an associative French-language framework including the French-language Belgian Radio and Television Authority (RTBF), the Swiss Radio Broadcasting authority (SSR), France 2, France 3, the French National Audio-Visual Institute (INA), the Financial Broadcasting Authority (SOFIRAD) and the Canada Quebec Television Consortium (CTQC) comprising the main broadcasters and producers in Quebec and Canada. The programmes on the channel basically comprise televised newscasts and magazines presented as the counterpoint to CNN, together with fiction, entertainment and theatrical and musical productions by the various French-language television channels.

Another network with planetary status is the MTV music channel, which was launched in 1981 in the United States and has not ceased to expand since then It has consolidated its position in every region of the world with MTV Europe, MTV Asia, MTV Brazil, Mandarin MTV and MTV India. This regional fragmentation is part of the new strategy of the channel, which consists in adapting to the cultural conditions of each region.

Although the international circulation of televised programmes has always been dominated by the developed countries, notably in North America and in Europe, major changes are taking shape. The trend is towards enhanced co-operation and a somewhat timid balancing of the flow of communication. The international circulation of programmes is becoming less of a mismatch as a growing number of Latin American, Arab and Asian broadcasters launch their own satellite TV channels. In this field, the conventional North-South cleavage appears somewhat narrower in relation to the other gaps between regions or major language communities. Asia, Latin America and the Middle East are asserting their presence and expressing a greater demand for news with a regional focus, while channels with international or regional status are developing and often competing with those of the Northern hemisphere.

In Latin America, the Mexican broadcaster Television has invested more than $250 million in the Panamsat company to set up its own satellite TV channels. The Mexican operator provides a pay-per-view service in the United States and in Spain. In Argentina, the Canal Sur channel telecasts a selection of news and entertainment programmes representative of South America over both American continents. For the Arab world, the Middle East Broadcasting Centre (MBC) channel telecasts from London via Arabsat to the whole of the region. Funded essentially by Saudi Arabian capital, it is picked up every day from Morocco to Iran with a programme featuring news, entertainment, cinema and religious broadcasts.

MBC today is fully equipped for digital broadcasting, but that eventuality will be possible only with the launch of Arabsat 2. Now that it has gone global, television displays whatever is happening around the planet, from the fall of the Berlin Wall to the massacre of Srebrenica or the genocide in Rwanda. It has become a bona fide worldwide counter-culture that undermines totalitarian regimes and renders state control of content ever more difficult and illusory. However, even if international television has enabled peoples that were previously deprived of images to open their windows onto the world, many feel concern about the power, the spirit of conquest and the scale of the networks, which have become nothing short of empires.

Domestic regulatory systems for the audiovisual sector feature a number of factors linked to the political, economic and cultural specifics of each country but also to economic and technological change around the world. The radical technological upheavals of the 1980s, combined with the expansion in television stations broadcasting by satellite and their increasingly international nature and structure, have caused major changes in the audiovisual field in every country. They attacked the monopolies held by national broadcasting authorities which traditionally have always controlled the various functions of programme production, programming and broadcasting. Marketing and globalisation have also brought the development of new markets with the emergence of private operators and that growth in their numbers, thereby undermining the conventional balance that existed between public and private sectors. These changes have been further amplified by the new possibilities of transmission opened up by digital broadcasting, as well as by the emergence of multimedia groups against a backdrop of internationalized markets, and finally by the growing importance of private interests in the audiovisual field. Faced with these new upheavals certain states have drafted a number of laws or taken decisions of a statutory nature.

In countries where radio and television are a state monopoly, their management is generally controlled by the executive body, which governs the administration and guides decisions concerning the production and broadcasting of programmes. This structural concept tends to disappear as the democratic process evolves. A public broadcasting authority is distinct from a state-controlled television service in that it enjoys editorial independence guaranteed by law and operates in a highly competitive environment. The state manages frequencies in order to prevent them from being used in an uncoordinated manner, and often supervises the financial management of the enterprise. On the other hand, regulation, wherever it exists, is controlled by independent authorities entrusted, according to the country in question, with regulating or supervising the programming activities of the private and public television operators. The authorities are generally placed outside the administrative hierarchy and are theoretically free from any judicial or political influence. Some are endowed with decision-making powers enabling them to organize the domestic audiovisual market-place and to control the legality of the conditions in which programmes are broadcast by private and public operators, and are even authorized to sanction occasional breaches of the law.

Different countries have different approaches to the authority in charge of regulating the audiovisual and telecommunications industry. In some countries, there is a single statutory body. This is the case in the United States, where the 1934 Communication Act entrusted the regulation of the vast area of the telecommunications and audiovisual sectors to a single agency, the Federal Communication Commission (FCC). The FCC is responsible for frequency management, supervision of the telecommunication networks operators and regulation of international communications on behalf of the United States.

The regulatory body is the Canadian Radio-Television and Telecommunications Commission (CRTC), set up in 1961; its main assignment is to allocate radio and television frequencies and to define the operating conditions of each licence-holder, particularly with regard to the quotas of Canadian works broadcast and to the enhancement of domestic production.

In Japan, the Ministry of Post and Telecommunications (MPT) is responsible for communications in the broad sense of the term, including postal services, telecommunications and broadcasting. In Italy, the Bill presented by the Italian Government in July 1996 provided for the creation of a higher authority to supervise the audiovisual and telecommunications sectors.

With the digital revolution and the convergence between the older industries such as the telephone and cable sectors, many conventional communication services, such as audiovisual services, can be routed through telecommunication networks. In some countries, cable operators can provide audiovisual and telephone services via the same physical medium. With the liberalization of telecommunications, new markets are developing and new operators are claiming the right to use competitor services on the same transmission system. The United States was the first country to take this change into account with the new telecommunications act adopted in February 1996, which completely opened up the communication industry to competition.

Anti-trust laws have been introduced into national legislation. They usually place ceilings on share-holding in the capital of television channels. If a closer look is taken, however, and the legislation mentioned above is kept in mind, regulation in this area particularly in the United States and in Europe is more akin to deregulation than regulation of the audiovisual sector, a finding in keeping with the principle of liberalization which is characteristic of most countries nowadays.

In the United States, the provisions of the 1984 Act on the concentration of operators on the American market have been slackened. The Act stipulated that no audiovisual consortium was allowed to reach more than 25 per cent of the American population, and it was out of the question to leave two stations on the same local market in the hands of a single owner. In the latest version of the law, the admissible percentage of the nationwide audience for all the stations controlled by a single owner was raised to 35 per cent. The networks today are also authorized to have their own cable companies. The new terms of the broadcasting Act relate to plurimedia ownership. They are intended to boost synergy between progress groups and local radio and television operations.

Many countries around the world have adopted rules that are both economic and cultural in their objective, forcing broadcasters to comply with quotas for programming and production of national works. By legislating on the quota question, states have sought to react to the consequences of the process of internationalization of the media on national television and film production and on the circulation of goods and services.

In Canada, the regulations stipulate that 60 per cent of all programmes broadcast annually must be Canadian in origin, and 50 per cent of those broadcasts must be during prime time. On Radio Canada stations, a 60 per cent minimum of Canadian programmes must also be broadcast during prime time. Canadian pay-TV stations have to allocate at least 20 per cent of their revenue to the production of Canadian programmes.

In Lebanon, the audiovisual law adopted by the Lebanese Parliament in November 1994 stipulates that 40 per cent of all the programmes broadcast on national channels must be Lebanese in origin. In France, statutory requirements include quotas for broadcasting films and audiovisual production, conditions for telecasting films, advertising rules and regulations, the protection of children and adolescents, and due regard for the French language. The effectiveness of these measures seems somewhat debatable, given the fact that viewers are free to watch other international channels if the domestic programmes do not suit their tastes, with the result that the ultimate effect of the measures may be diametrically opposed to their initial purpose.

European regulations for the audiovisual field are based on the celebrated 'Television without Frontiers' directive of 1989. The purpose of the document was to coordinate certain provisions laid down by law, regulation or administrative action in member states of the Union concerning the pursuit of television broadcasting activities. The most controversial aspect of the directive was the obligation for all European television channels to devote a majority of certain time-slots to broadcasting programmes of European origin.

New opportunities

Advocates of the modernization paradigm consider that the transfer of new information and communication technology is a major stimulant for the development process that, in the long run, will enable the developing countries to catch up with the industrialized countries. For others, the opponents of 'cultural dependence', any such transfer would merely be a step further not only towards inequality, but even towards the destruction of the cultural identity of societies in the Southern hemisphere. For others again, both the paradigms of transfer and dependence are outdated.

New information and communication technology and its applications provide developing countries with the ability to perform a kind of technological leapfrogging that could enable them to reach the connection capacity required for the information networks far more rapidly. Similar forms of leapfrogging might also enable economies with a high level of skilled labour to switch to value-added economies.

An increasing number of states share the latter point of view and have opted for the most advanced forms of technology to implement or renew their communication infrastructures. To reach their objectives, on the one hand they have adopted policies of adaptation and technological transfer by offering attractive subcontracting capabilities, thereby relocating communication multinationals; on the other hand, they are investing in communication programmes or setting up new communication infrastructures.

Most of the developing countries are confronted with economic and political alternatives of a strategic nature, but also with constraints and obstacles that they will have to overcome or manage if in the future they wish to set up gateways with the networks and services promised by the information society. These obstacles are financial, technical and political in nature. Although it began in the industrialized countries, the development of the new information and communication technology is gradually spreading to the whole world, offering tremendous opportunities for every society to access knowledge and know-how.

This trend can be seen in the Arab countries, with the installation of communication infrastructures capable of providing new opportunities for distance learning, health and many other development-oriented activities. Gulf states, i.e. Bahrain, Kuwait, Qatar and the United Arab Emirates, have practically reached the objective of a universal service. They have almost all fully digitized their networks and offer state-of-the-art services characteristic of developed countries. Less advanced Arab states have inadequate access to the Web. The issue for these countries is how to improve access to telecommunications against a backdrop of low-level economic development. In the third group of Arab states, the level of development in telecommunications is situated between that of the wealthy countries of the Gulf and that of the less advanced countries in the region.

During the coming years, most Arab states will be faced with the task of accelerating progress in their telecommunications sector in order to bring them up to the level that some developing regions have reached and to expand their service offers, both of which are indispensable prerequisites for active participation in the new global information economy. Arab states have an advantage, compared with other developing regions, in that they can count on diversified sources of potential financing. Telecommunication companies in the Gulf are not only an example of successful development, but can also provide technical and financial support to operators in the other Arab countries.

Development of the information society in the Arab states will be possible, provided that governments use the new information technology efficiently, notably to reduce the gap in development between nations and within them. With this outlook in mind, satellite operators, and the users and creators of content as well as specialists in information and computer technology, have vast possibilities for initiating innovative approaches in the field of communication, taking into account the potential for development and market opportunities. Within this framework, the ITU and UNESCO are working together to promote the use of telematics for social, economic and cultural development in the region.

An important step in this process was the creation in March 1996, endorsed by both organizations, of an association for cooperation in the area entitled the Regional Arab Information Technology Network.

First, the introduction of new information and communication technology requires extremely heavy-investment, estimated at several hundred billion dollars, a sum that most developing countries can neither raise nor commit. Most of these states are currently confronted with obstacles to development and are subject to structural adjustment plans that force them to limit their expenditure.

Second, the hypothetical presence of these countries on the future electronic networks presupposes the installation of terrestrial or satellite telecommunication networks, the management and control of which seem incompatible with the obsolete and under-equipped level of local telecommunication services.

Third, the future information society presupposes fair, universal access to the Web for the whole population of a country. The geographical dissimilarities within these countries, however, are alarming. They stem from the political options that have been adopted by governments which are generally centralizing in outlook, resulting in fairly top-heavy media concentration, with telecommunication services located in the capitals and major provincial capitals.

Those problems and obstacles clearly illustrate the challenges that the developing countries must face: implementing a new information and communication policy in order to modernize, democratize and diversify the services on offer. The first of these challenges entails favouring a worldwide strategy for the reform of communication services.

The need to modernize communication equipment presupposes the transfer of the new technology and intensive use of the services it provides. The funds required, however, are such that modernization inevitably entails monopoly deregulation, a fact which has now become the reference framework for any upgrade or modernization of communication policy. Most developing countries are fully aware of this need, and have already opted for deregulation or privatization by having their companies join the trend of internationalization and partnerships with the major operators in the industrialized countries. Without subscribing to some form of liberal economic determinism, privatization can probably solve a number of requirements, including that of providing the specific value-added services necessary for any connection with telecommunication's networks. On the other hand, privatization can be seen as a legitimate means of socioeconomic change only if every class of society gains some benefit from it. This is precisely the reason why privatization must be accompanied by a statutory framework guaranteeing that all sectors of the population, in particular those people living farthest from the major cities, have access to the basic information and communication services, just as, through partnerships or alliances, it should facilitate access to every form of information and communication flow, whether by telephone, audiovisual programmes, the written press, etc. The success of privatization presupposes the existence of an open market, strong local enterprise, and fair market rules and regulations to counterbalance the risk, inherent to privatization, of the emergence of new monopolies.

Most developing countries have modest, even outdated telephone services and audiovisual equipment, which cannot easily be adapted to the digital transmission used by electronic networks. The experts take the view that this deficiency can be made up by satellite technology which will complement the existing terrestrial cellular telephony systems and transport large amounts of data at low cost. The system of transmission by satellite seems to offer several advantages, notably that of covering vast areas and reaching populations in regions with difficult terrain and hostile climates that cannot be covered by Hertzian means. Satellites make it possible to broadcast educational and cultural programmes and distance learning courses throughout a country, and finally to connect up to electronic networks. This point seems worthy of note, since the technical capabilities and possibilities of planetary networks, the most well-known of which is the Internet, seem closest to the idea of open, limitless communication. It is also a practical, economical solution for developing countries if they wish to have access to a universal system of communication that can make good a number of deficiencies, notably in terms of point-to-point communication.

Access to know-how and training in every country is a major priority. The acquisition of know-how and knowledge, which today fill the role played first by landownership and later by capital in transforming modem society, has become a priority in national development strategies. New information and communication technology is seen as an important means of completing and consolidating the traditional techniques of teaching and learning. Virtually everywhere around the world, development programmes are making increasing use of satellite television, telematics, and even video-conferences in education, health, family planning and community development. The technology permits transmission throughout the national territory of adult training programmes and distance learning courses tailored to suit all kinds of public.

In addition to these advantages, if the various costs of training, such as travel in developing countries between badly-serviced rural areas are taken into account, distance learning based on new technology seems particularly cost-effective, and will become even more so as its use develops. In the medical field, new technology such as picture phoning, video-conferences and medical encyclopedias on CD-ROM are responding increasingly to a demand which already exists at the experimental level. In a few years, doctors, hospitals, laboratories and universities will be networked and capable of telemonitoring diagnoses, analyses and examinations transmitted from one end of the world to the other in record time, via computer and video systems.

6

Information Technology in Digital Age

The issues raised by the progress in technological convergence and industrial conflicts, there remain a number of problems: those concerning the place of copyright and neighbouring rights in the future information society, those with respect to national cultures and their diversity in the general trend towards globalization, and finally those of the new information and communication technology in economic, social and cultural development.

Media globalization together with the arrival of competition from international and national private television channels raises the issue of the status, role and future of the public service in the new audiovisual fields around the world. For many years, public television channels enjoyed a period of stability based on a monopoly.

There are three main reasons for their domination. The first of these is technical, and concerns the use and distribution of frequency spectra considered to be a collectively owned, rare resource. In this area, the state played the role of a microwave 'regulator', to prevent frequencies from being used in a disorganized and anarchic manner. This function is generally performed today by an authority independent of the government, its role being to enforce conditions of fair competition. The second reason concerns the public service role which is conferred on all the broadcasting services. The power of radio and of television seems truly vast from the political, social or cultural viewpoints, since it provides the general public with access to cultural information programmes that they would not be able to receive elsewhere or otherwise. The third and final reason is linked to the traditional distrust of public authorities with respect to the market's capacity to perform the public service assignments imposed on the broadcasting industry.

The arrival in the 1980s of private operators and distributors on the market had as its consequence the end of the supremacy of public television channels, a setback which then depleted their audience ratings and advertising market share. Technological innovations in the satellite area also led to the development of new markets, accompanied by an increase in private capital and publicity investments in television. Since then, the growth in private channels has taken place to the detriment of advertising revenue for public television, undermining the traditional balance between the public and private sectors. These various reversals have occurred in an environment of increasing internationalisation and worldwide televisual exchange.

All around the world, clusters of private, general-interest or specialized digital television channels are springing up in audiovisual market-places which are becoming increasingly turbulent. Against this backdrop, the public channels have had to face stagnating or diminishing public subsidies, forcing them to reduce their expenses or seek other sources of revenue such as the introduction of TV commercials. Reduced government involvement in public service channels in several countries, notably those in Europe, has accelerated the rate of change in the audiovisual marketplace and thrown the public television sector into disarray.

Future of public service broadcasting depends on a clearer distinction between public service and public sector, which are two very different concepts altogether. Privately owned television operators exist that provide educational or cultural programmes, traditionally classified as being the role of the public service. In the United States, for example, the major networks such as CBS, ABC or NBC also provide programmes of an educational and cultural nature, as does the federal CBC Radio Canada network. These programmes are all part of a complementary, diversified offer. The assignments and obligations of the public service are not necessarily incompatible with the ownership of corporate capital, and the difference between private and public as diametrically opposed sectors is no longer pertinent. The concept of public service seems nevertheless to be gaining ground in Europe, and is even moving towards that of universal service, notably where the texts of the European Union are concerned.

A universal service is seen as a compensatory factor within a market- controlled regulation system. The future of the public service also depends on a clearer distinction between public service and commercial television, which obeys market laws first and foremost. The public service should be free of economic and financial considerations dictated by audience ratings and market share, to carry out its role as a social link. In a world open to the internationalization of data flow and image exchange, a public service should provide basic landmarks of a historical, cultural and political nature for a nation. It should embody, among other things, the relationship that a people has with both its image and its imagination, hence the importance of the provision by public television of true diversity and pluralism to its viewers.

The development of the information society raises the issue of the inequalities which are a feature of both the industrialized and the developing countries, and which at the same time come between the rich and poor within the same society. The developing nations are confronted with the challenges of the new technology, the production and distribution of which take place outside their frontiers.

Copyright and intellectual property rights

Copyright and neighbouring rights form one of the very first areas of international co-operation. International structures for the protection of copyright were set up from the end of the nineteenth century onwards. The 1886 Berne Convention was the first multilateral agreement instituting the international protection of literary and artistic works. Since then, the convention has been revised several times, most recently in 1971. It guarantees creators a high level of protection of their rights. The Universal Copyright Convention, adopted under the aegis of UNESCO in 1952 in Geneva and revised in Paris in 1971, obliges signatory states to ensure effective and adequate protection of copyright, leaving them free to adapt that protection to the requirements of their socio-economic reality. It was this convention that introduced the @ symbol followed by the name of the copyright holder and the year of first publication, to replace the registration formalities required by certain legislations. The Rome Convention, signed in 1961, provided a flexible, inter national legal framework for the protection of performers, producers of phonograms and broadcasting organizations.

Digital technology provides a major opportunity for intellectual and creative works in that they can be disseminated an infinite number of times. That self-same power of dissemination, however, can also lead to the violation of copyright, notably through piracy and other forms of computer crime. Around the world can be seen an increasing number of flourishing unauthorized businesses manufacturing and marketing illegal 'smart card' decoders for the reception of telecasts without the payment of any licence fee. Piracy and the other forms of counterfeiting are a major problem whose economic consequences cost tens of billions of dollars every year. All these risks are a cause for concern among creators and have led states to examine the usefulness of creating a special legal system for the new digital environment.

At the international level and as part of the work carried out by the World Intellectual Property Organization (WIPO), most participants consider it unnecessary to draft new special legislation.

Two basic viewpoints have emerged on the subject, however. The first consists in applying distribution rights together with reproduction rights to works transmitted via digital means. This is, for the most part, the position defended by the United States, which proposes to consider transmission as a form of distribution, whether it involves 'on-line' transmission or the dissemination of the reproduction of a work recorded on a material medium. The American position requires that international transmission be considered as a form of import. The second viewpoint regards the act of digital transmission as an act of public communication. This is the position of Argentina, Australia, Canada, Japan, the member states of the European Union, and Uruguay, a point of view backed by several nongovernmental organizations. Public communication rights would be combined with reproduction rights when the end-user makes a copy of the work transmitted.

The WIPO treaties on copyright and neighbouring rights adopted on 20 December 1996 in Geneva contain no provision with respect to reproduction rights in the digital environment for lack of agreement on this sensitive point. On the other hand, Article 8 of the Copyright Treaty implies that the digital transmission of works via networks is an act of public communication governed by the exclusive rights of right-holders. The adoption of this article, however, was linked to an interpretative statement to the effect that it is understood that the mere provision of physical facilities for enabling or making a communication does not in itself amount to communication within the meaning of this Treaty or the Berne Convention.

The declaration further indicates that the provisions of the treaty with regard to limitations and exceptions do not prevent a signatory from applying of the Berne Convention. The statement seems to suggest that the provision of the physical facilities for enabling or making a digital communication is not a sufficient stage in the digital communication of works to warrant protection under copyright laws. It leaves a number of questions unanswered with respect to the liability of providers of wide-area networking servers in the process of digital transmission.

At regional and national levels, the issue has become particularly acute with the publication of the US White Paper of September 1995. Drafted by the Working Group on Intellectual Property Rights of the White House Information Infrastructure Task Force set up by President Clinton in 1993, the document contains detailed proposals for adaptation of the US Copyright Act to cyberspace. Their concern has also been echoed in Canada with the report of the Information Highway Advisory Council, which was published the same year.

The importance of protecting intellectual property also led the European Community in 1988 to present a Green Paper containing an economic and judicial analysis of the various problems raised by the new information technology in legal terms. Multilateral discussions held during the drafting of the paper resulted in the adoption in 1995 of the Green Paper on Copyright and Related Rights in the Information Society. It lists a catalogue of fifty-five problems concerning future copyright. The paper followed the Bangemann Report of June 1994, which considered the protection of intellectual property to be a crucial element in the development of a European multimedia market. The European Commission has announced another Green Paper specially devoted to the legal protection of encrypted signals, and has raised the possibility of intervention by the Union to make technical protection systems mandatory when the former have been sufficiently developed and accepted by industry. Finally, also worthy of note is the CITED project (Copyright in Transmitted Electronic Documents) developed under the ESPRIT programme.

For its part, UNESCO, which initiated the Universal Copyright Convention (1952), was an active participant in the Diplomatic Conference organized by WIPO in December 1996 with a view to adopting a new protocol to be appended to the Berne Convention. The presence of UNESCO at the conference, as well as at those organized by the European Commission on Copyright and Related Rights on the Threshold of the Twenty-first Century (June 1995) and at the Intellectual Property Conference of the Americas (July 1996), was intended primarily as a means of achieving a consensus on an arrangement reconciling the respective rights of authors, producers, copyright holders and the general public, as well as those of exporters and importers of protected works.

UNESCO also launched a wide-ranging consultation with specialists in the field of communication, publishing and development. In that connection, worthy of note was the organization in co-operation with the Spanish Government of an International UNESCO Symposium on Copyright and Communication in the Information Society. Discussions at the symposium focused on three major subjects:

— The outlines of a national policy to set up the basic infrastructures for the digital transmission and broadcasting of information, and the norms that should govern the operation of those infrastructures, as well as the principles for regional and international co-operation in the area.

— The guidelines to follow in order to adapt national legislations so as to ensure that they protect the legitimate rights of authors and other right-holders in the digital and multimedia environment and enhance harmonization of those rights at the international and regional levels.

— Strategies for national policies aimed at fostering the creation and development of cultural economic sectors, the digital broadcasting of works and performances, and distance teaming, with a view to international and regional cooperation in this area.

The symposium was followed by a series of regional meetings of Committees of Experts on copyright in the information society. The first of these, for Latin America, the Caribbean and Canada, was held in Bogotá in September 1996. The second, for Asia, the Pacific and the Arab States, was organized in New Delhi in November 1996. The Committee of Experts of Europe is scheduled to meet in Monaco in March 1997 and that of Africa in 1998. On the whole, the various meetings have agreed on the need to simplify legal rules at the international level, in order to maintain a three-way balance of:

— the rights of authors in relation to those of the traditional cultural economic sectors and of information highway service providers,

— the rights of right-holders in relation to the public interest, and

— the interests of countries exporting 'copyright' in relation to those of importer countries, notably the developing nations.

The balances are closely connected to issue of the access to information and to new communication technology and contrasts the views of three groups of thinkers. Those that relate network access to a fundamental fight on the same grounds as other rights; those that consider access must be modulated in relation to the varying contexts and types of information in question; and finally, those that would make all network access part of a commercial service. The absence of legal protection is not supportive of creativity worldwide, and it is equally obvious that over-protection is not conducive to access to the networks by research workers and academics of developing countries. The correct balance therefore remains to be found between the right of creators to benefit from the use of their work and the needs of users to access those works and use them freely.

One further suggestion, developed by a number of non-governmental organizations in particular, militates in favour of a political alternative, based on non-market mechanisms ensuring right-free access for underprivileged countries to digital productions connected with social and economic development. Other ideas, based for example on consumer initiative or on codes of ethics developed ad hoc by information professionals, may suit the complexity of the problem and ultimately be more effective. This only underlines, however, the vital role of dialogue and co-operation among the various parties concerned, which, alone, may enable the right balance to be found between the interests of some, the duties of others and the solidarity of all.

A Canadian example to how to approach copyright and intellectual property rights is explained below. The Final Report of the Information Highway Advisory Council, published in September 1995, examines copyright legislation and practices in the context of a digital environment.

1) *Principles*: The federal government should adopt principles for copyright in the context of accelerated digitization of information, based on the following points:

   — Maintaining a balance between the rights of creators to benefit from the use of their works and the needs of users to access and use those works on reasonable terms,

   — Encouraging industry, creators and user communities to develop and implement an administrative and regulatory framework that is easily understood and implemented by all interested parties and not seen as a barrier to access or use of the content on the information highway,

   — Recognizing creativity as required for the information-based economy and the multiple roles of individuals of the information highway,

   — Encouraging the creation of works that are critical to a national and cultural identity and economic development.

2) *Browsing*: If the information highways are to be viable and sustainable, creators must be guaranteed continued protection of their works. At the same time, users must be assured of fair and reasonable access to those works. In its final report, the Copyright Subcommittee concluded that the act of browsing a work could mean either accessing a work, even if it is temporary or ephemeral in nature, or the making of a copy.
3) *Fair dealing*: In the context of copyright, accessing and reproducing works in a digital environment is increasingly complex. It is important that users comprehend better the extent and nature of copyright liability.
4) *Moral rights*: Moral rights include, among other things, the right to paternity and the right of integrity of the work. The right of integrity is attached to the honour and reputation of authors who, in order to seek remedy, must show that their reputation has suffered from the modification of their work. The alteration or mutilation of originals of certain artistic works also infringes the author's right of integrity.
5) *Crown copyright*: In the council's view, ensuring universal and easy access to public information on the information highways does not require the abolition of Crown copyright, but instead a more liberal approach to making works of the Crown available to the public should be adopted.
6) *Distribution right/ownership*: The right to communicate to the public by telecommunications currently contained in the Copyright Act clearly applies to the electronic transmission of works to the public. There is therefore no need to introduce any new rights, such as an electronic distribution right.

7) *Administration*: Upon review of the range of mechanisms that could be developed to track and enforce copyright on the information highways, the council concluded that the above combination of technological, policy and legislative solutions was appropriate. The industry itself, with the assistance of the federal government, is best suited to developing the technological solutions.
8) *Public education*: Both users and creators and the industry in general need to better inform themselves about the rights of creators and the responsibilities of users on the information highway. The federal government can lead by example by exercising copyright in a responsible manner, by participating in copyright enforcement programmes and by ensuring that government works are broadly and routinely distributed. The talks have at least brought to the attention of international opinion the extent of the disparities and distortions that exist in the area of communication and new technology, imbalances suggesting that the vision of a global village which so many have held for so long will basically be attained by the richest or most recently industrialized countries in which the data banks, software systems and programs are gathered and stored.

Market globalization favours communications between developed or newly industrialized countries or within such countries, or links between major cities and rural zones. In the economic sphere, the imbalances reflect both the highly unequal economic development of nations, the diversity of their political systems and the specific character of each society. They can be explained as much by the past as by certain current effects of globalization. These somewhat pessimistic observations must, however, be tempered by the emergence of a number of Asian and Latin American countries that have worked wonders where telecommunications and audiovisual technology are concerned. Some even form the driving force behind economic growth rates that contradict the climate of recession in the rest of the world. Others have begun policies for technology transfer and adaptation offering attractive subcontracting capabilities and thereby off-sharing communication multinationals.

Imbalances between nations and within them, together with the acceleration in the globalization of the contents of programmes, also arouse concern about the dangers of cultural and linguistic standardization. Developing countries are at risk from standardization of local cultures through a form of planetary brainwashing caused by the white noise of poor programme content. These dangers may have grave consequences, such as the marginalization and possible disappearance of fragile community cultures, the weakening of cultural foundations, the temptation to withdraw into an identity coinciding with religious beliefs, and the threat of violent inter-ethnic conflict. While the existence of these dangers raises questions of ethics and political sovereignty, they have also been used by some states and their single parties as a convenient alibi to justify their stranglehold on the media and the use of the media.

The member states of the European Community also appear to be jealous of their cultural identity and make it a fundamental factor in their national sovereignty. They are striving to protect their audiovisual production by a policy of broadcasting quotas adopted within the framework of the directives of the 'Television without Frontiers' programme. The economic issues implicit in quotas became a subject of confrontation with the United States during the GATT trade talks in 1993. There are two contradictory viewpoints on the subject.

The United States is pushing for the free circulation of programmes, while Europe and Canada intend to protect their cultures and their film industries by arranging programming rules. The Americans wish to encourage a form of total market internationalization and the globalization of trade, whereas Europe and Canada consider the audiovisual field to be a service whose cultural purpose justifies its treatment as a special case in relation to the overall GATT agreements. Hence the importance for the European Union to have an audiovisual and cinema policy designed to preserve cultural identities, to strengthen economic development and to create jobs in the audiovisual sector.

However, according to the European specialists, the results of the GATT trade talks hardly changed anything, either in terms of the current market situation, which favours American programmes, or with respect to the risks of furthering their market domination with the arrival of digital clusters of TV programming streams. As digital technology rapidly develops, however, the scope of deregulation is widening in Europe to include the private telecommunications sector.

Future prospects outlined in the European Commission's Green Paper on the audiovisual policy of the European Union are already those of a demand focus on profitability in an open, dynamic global market' based on a largely free trade attitude. On top of this, the renegotiations of the 'Television without Frontiers' directive reached a compromise with some difficulty as a result of strong reluctance on the part of countries such as Germany, the United Kingdom and Italy, all of which demanded the straightforward abolition of the quota policy.

7

Information Technology: Tools of Tomorrow

The increasing complexity of the network environment, together with the growth in user access as physical networks reach down to the desktop workstation or personal computer, brings into sharper focus the need for easy to use navigational information discovery and access tools. Information can sometimes be available faster in electronic form now than in the printed equivalent. A clear trend is towards a situation in which the end user interacts directly with the information source, rather than through a human intermediary.

Many of the problems in organizing and making accessible this confusing wealth of information resources seem analogous to those which the traditional librarian has faced with printed material, although the solutions may not be directly transferable. A potential role for the information specialist is in helping to define the tools which can be directly used by clients to reveal the information they require. Although such tools have begun to emerge, they are at present developing from technical and computing disciplines, rather than from the information profession, and tend to lack a sophisticated view of the information transfer process. Information discoveries and retrieval tools are merely the ancestors of future approaches which will more truly address the underlying problems. The main arena in which these type of tools have been developed, often as co-operative experiments, has been in the field of research and academic networking; since network resources are seen as one form of educational resource to be exploited for both research and learning purposes, and perhaps because an opportunity has existed in this environment to develop such tools in response to perceived need, without early commercial pressures.

Resource guides

Resource guides to network facilities has been a particular feature of the research networks environment. Project Jupiter in the UK resulted in the Guide to Janet Resources; and on the internet in the United States, several printed and online guides to available databases, archives and online library catalogues have appeared.

However, the printed guide, or online text document, is not well suited to comprehensive coverage of the fast changing network environment. A database which can be queried from any network node can provide faster and more authoritative information on changing resources and locations. A dynamic resource guide of this sort should be able to identify and access resources by providing a listing and description of resources, providing a means for selecting from available resources or by providing access to the user. The scale of the problem is such that no single centralized and updated guide is likely to be feasible in providing these mechanisms.

A resource guide can consist of a central database which can be updated from local sources with local information; or a distributed database which can redirect queries to the local site for processing in a web of co-operating databases. A distributed X.500 directory would seem an attractive option here, although there is doubt whether the present standard is capable of providing an adequate solution at the scale which the problem requires. The distributed approach presupposes a level of agreement on standard descriptions for classes of item, and on protocols for the routing of queries between local databases.

To provide the user with immediate access to the resource, the guide would need to contain routing information as well as a description, so that sought items could be retrieved in full without further action by the user. Several proposals have been made on schemes for organizing and uniquely identifying resources, particularly in the internet world. The Internet Engineering Task Force has proposed a three-tier scheme which is intended to tackle this problem, comprising of:

— *Universal resource identifier*, which is used to identify the existence of an information object;

— *Universal resource locator*, which gives access information for an object;

— *Universal resource number*, as a basic description of the item itself.

A number of problems with electronic information items in such an uncontrolled environment: the possibility of loss of information in different versions, and at which point this degradation adversely affects equality of content between different instances of the same record; the problem of version control; the identification of name changes in, for example filenames, for items with the same content. Such problems have yet to be resolved within a satisfactory analytical framework in a way which is widely applicable, and may require the use of 'intelligent' software to implement effectively.

Use of MARC format cataloguing records has been proposed as a more traditional solution, and the feasibility of this approach has been investigated by the OCLC organisation. The final report proposed the creation of a new field for location and access information, but suggested that the relative scarcity of formally published information made the extension less attractive. No clear scheme has emerged as having majority agreement, and it may be that a traditional universal citation and mapping approach is not an appropriate solution.

Topnode project

Topnode project is an attempt to create an overall directory of directories, catalogues, resource lists, network services, and tools, together with pointers to other sources of information. This is being carried out under the auspices of the coalition for networked information, It deals with internet resources such as:

— directories of networks;

— general and discipline-based online resource guides;

— government and public information resources;

— 'white pages' directories of individuals;

— electronic journals and newsletters;

— organisations, tools, and systems.

Topnode has developed a proposed record format which includes pathway information for locating an item, as the structure for a centralized database which will update local copies of the data.

In 1992, an ASCII version became available, with future plans for the development of a Dynamic Topnode which is capable of taking the user directly to the item in a transparent manner. A newly formed Internet Network

Information Centre (InterNIC) proposes to develop a similar directory of directories, and maintain resource description files with regular updates. This will be a distributed information base, and will be able to dispense resource information in discipline-specific 'packets'. The development of the Internet as a National Research and Education Network, and the growing emphasis on networking for economic development, seems likely to encourage these more formal initiatives.

Hytelnet package

Hytelnet is a terminate and stay resident (pop-up) hypertext browser which provides an IBM-PC user with information on access to library catalogues, campus-wide information systems, free-nets, bulletin boards, and other network resource tools which may be contacted through the Internet. The program gives information on using the Telnet IP protocol to access these systems, but does not make the connection itself. Despite this, it is widely available in the public domain, and is updated regularly. The package is a useful adjunct to the desktop workstation user.

Online directories

Online directories which do exist have much more limited aims and cover only small, specific areas. The WHOIS server is present on many Internet sites, containing information on network names and network users on a limited scale, by offering directory services related to the organisation to which it belongs; there is no attempt to share a common directory with other organisations, Servers of this type, however, can be accessed from other points on the network, either by remote log in or through electronic mail. Bulletin boards and campus information systems may also contain directory information of this sort.

Client-server tools

Much of the information discovery and information management tools has emerged from the internet, reflecting the great amount of freely available information and a user community with the interest and skills to develop the tools. For this reason, such tools are designed to run across TCP/IP based networks, and normally demand a direct connection from a host system, or for the user to have remote access to one. They have usually developed from research projects, and many are in the public domain rather than being commercially available as products although there is a tendency for the most successful to move in this direction. Many have also been implemented on a variety of standard hardware platforms as both clients and servers. Information discovery tools are software programs which perform specialized tasks for one particular kind of resource: retrieval of text documents, identification of software programs, or management of user access. They are designed to perform two main interrelated tasks: to manage and make available the contents of large databases and disk directories from one location; and to assist a remote user in finding and accessing information from a number of different sources at different locations.

The server is responsible for maintenance and management of the information base, dispensing answers to queries submitted by a client. The client is responsible for interacting with the user in the most appropriate way, managing the user interface and passing queries back to the server in an agreed format without requiring the user to know what this is. A protocol binds these two parts together, forming the common language into which both queries and results are coded for transmission across the network. Since these tools have evolved from the Internet environment, purpose-built protocols of this sort are predicated on the use of TCP/IP as the underlying transmission medium.

Information retrieval tools

These tools are aimed at discovering the location of information resources over a large number of different sites in different countries and possibly making them available, in such a way that the user need not be aware of the location or connection mechanisms involved.

Archive

There are many hundreds of ftp archives, each containing a large number of individual items. The ftp file transfer protocol is used in the internet to store and access documents and other items in 'ftp archives', as an open resource to all network users. Copies of the same item may be stored in several different locations, some of which may be easier for a particular user to reach. Various versions of the item may be available from these sources. Archie is a system for maintaining an up-to-date catalogue of software programs, documentation, and code which are available on internet ftp sites.

The server program consists of two parts: a database gathering facility, and a database maintenance facility. The gathering facility monitors the contents of about 800 internet 'anonymous ftp' sites around the world to retrieve a list of software filenames and keep this up to date, listing which site has which titles in which versions. A percentage of these sites are automatically monitored every night to check for changes, so that each individual site is updated about once a month.

Having gathered this information, the database maintenance facility maintains the result in a database providing a simple index for retrieval purposes. A user can run a client program to connect to one of 15 duplicate copies of this database around the world, and can search for particular filenames by entering exact or close match keywords. The client program controls user access, and will handle the transaction with the database.

A successful query will result in the display of a list of filenames, size and versions together with the internet address and necessary directory path information for each; showing how the cited files can be retrieved in full. This listing can be used to choose a convenient location for directly fetching the file from a remote ftp site, and contains the details necessary for the user to activate the file transfer process. Archie can be used by connecting to a remote client by means of a Telnet session from a standard terminal. In this case, the user must directly initiate the ftp file transfer protocol 'by hand' in the normal way. If a client running on the user workstation is being used, however, the complete process of searching for, locating, and transferring a file is contained within the single user interface, without the need to change the program in use; once a transfer is asked for, the workstation client will start and control the ftp process by itself.

Archie is also able to show a complete listing of the ftp sites which are represented, and to display the contents of individual sites. The system maintains a software description database containing the name and description of software packages, documents and datasets which are contained in its database. In this way, the user can approach the data from various access points. Archie is a quite unsophisticated facility in information retrieval terms, with a simple command interface, but is of interest in that it is able to maintain an up-to-date catalogue by automatic means. Searches conducted on archie can, however, result in large result sets when the same filename is located at very many sites.

Wide Area Information Server (WAIS)

The Wide Area Information Server (WAIS) is a system which performs a similar function for document files. WAIS was developed by a consortium of companies primarily for an internal application in the first instance. These consisted of the Dow Jones Corporation, Apple Computers, KPMG Peat Marwick, and Thinking Machines, a company specializing in powerful parallel processing computers. The system was intended to aid in the selection of databases from a large number of possibilities, and to support searching by a non-expert user with no need to understand the underlying data structure of the database chosen, as well as helping to manage the results of the search in the user's workspace. Since its first appearance in 1990 has proved very popular, acquiring 10,000 users and serving more than 100 databases in its first year. It is not yet a commercial product, although later versions will be so, and is available for installation on a range of different hardware platforms.

Different hardware implementations of WAIS offer slightly different facilities to the user. WAIS is based on the Z39.50 standard protocol for information retrieval, developed by the US National Information Standards organisation and adopted as an ANSI standard. This is intended to overcome problems of different user interfaces and terminal emulation requirements of heterogeneous information retrieval systems on a network, by allowing one computer to act as a client in performing information retrieval searches on another remote computer, which is acting in server mode. Z39.50 is intended as a machine protocol, not as a search system for human use.

WAIS is one implementation of the protocol in software, which augments the basic protocol by adding its own ideas on searching. It allows a user to perform full text information retrieval searches on text document sources, through simple keyword indexes, and to refine the search through relevance feedback techniques. On starting a WAIS client, a user can select from a screen list one or several sources (filestores) in which to search wherever they are located geographically, and enter one or more keywords as the basis for the search. The client passes the search to the server which is responsible for indexing and retrieving the documents; the results are ranked by a weighting based on the percentage occurrence of each keyword in the document. The client program enables the user to view the document, assess its relevance, and feed this back to further refine the search in order to find similar documents. Once satisfied, the user can select a document for display on the screen.

Documents must be indexed by the WAIS software prior to retrieval, when setting up the server. WAIS indexes all words of more than two characters, building a simple inverted file system. Since this produces large indexes, and the technique was designed with very powerful computers in mind, the process can be quite slow in some cases.

While WAIS and Z39.50 provide a uniform procedure for interoperability between information retrieval systems, and the means for one client to query several different sources in the same way, it must be integrated with the overall software application to work; essentially WAIS is a protocol which can be implemented in different presentation formats. The WAIS system is often used as the 'back-end' system which acts as the retrieval engine for very different presentation programs. A range of different clients can be used with a WAIS server, as long as they can translate the queries into the standard protocol for transmission.

The National Information on Software and Services (NISS) information service on Janet provides a WAIS option which allows a user to search several different Janet information sources simultaneously—one, for instance, is the contents of the Bulletin Board for

Libraries. Columbia University Law School have installed a WAIS front-end to search for digitized text and image archives, as a viable means of preserving historic documents while still making them widely available to researchers.

Experimental uses of WAIS include its use to provide a single consistent client search interface to multiple CD-ROM databases across a local area network. The Thinking Machines Corporation maintains a recent directory of WAIS servers. The WAIS approach has gained a strong currency in a short period of time over a wide audience, principally by behaving as an open standard and making the source code freely available. This has encouraged many different implementors to add to and enhance the initial facilities, and means that in principle, new information types such as audio and video can be added. The system is heavily weighted towards a free-text searching approach, however, and may not be well suited to other formats. This free extendability also threatens to encourage a drift away from its initial roots in the Z39.50 standard, which is itself undergoing revision. This would result in a fracturing of the open standards process, and encourage an unwelcome multiplicity of protocols which are similar but different.

Gopher IT tools

Gopher is a means of building a local, customized view of the network by making links between individual items, so that they are presented in one structure regardless of location. Gopher software clients have a seamless view of the information thus linked in the gopher 'world', even though it may be distributed over several different sites. The client can navigate through a hierarchy of directories, or ask an index server to perform a full-text search on document sources for direct access, as though all the information were situated locally in one site. To the user the information items appear as a series of nested menus similar to the directories and sub-directories in a file system, and can browse through links which point to individual items or broader services, or to other information sources elsewhere on the network.

Objects listed on a gopher menu can be:

- text or binary files;
- other directories or sub-directories;
- a telnet session linking to a different service;
- an index-search for searching on text strings;
- a phone book server;
- a sound file;
- a graphic image file;
- a hypertext link.

Gopher service mixes basic network services such as telnet remote log-in sessions, file transfers, database searches, and newsgroup message browsing without the user having to know the details of any of these directly, or even being aware of being moved from site to site as the session progresses. All is performed behind the scenes, and the network navigation appears identical to use of a local system. Index-searches perform full-text searching based on keywords, and return a virtual directory which is a linking map of all documents satisfying the individual request. Information is published-made available to a gopher client by a gopher server system, making all files and directories below a certain point visible for retrieval by gopher clients.

A gopher client is pointed to a server by configuring the client with a network address; any gopher client can point to any gopher server. A gopher server can provide links to other gopher servers making a web of links which can be navigated by the user transparently. Since multiple links can be made to a particular point, an individual information resource may be discovered by more than one pathway. Although the menus appear as hierarchical to the user, they are in fact a network or 'web' structure; this web is known as 'gopher space'.

The term gopher strictly refers to as protocol a well as the suite of programs developed by the University of Minnesota in which the protocol is implemented. The project was originally initiated in order to build a campus wide information system (CWIS) at this university, as an information delivery system for local information and to provide access to other CWIS systems.

Minnesota University remains a central point in the gopher web, which has spread very quickly since its inception to a large number of servers creating a global level web. This provides a simple, effective, and easy to use method for opening out networked information resources to a wide audience, and has strong potential for libraries and information services.

The gopher concept has been quite extensively used to provide campus-wide information systems elsewhere and to support collections of institutional-based documents, and to a lesser extent to develop subject-based information systems as well as experimenting with the delivery of electronic journals. A range of gopher client programs are available for the most popular user workstations, including Macintosh and MS-DOS computers, X-Windows workstations, and OS/2 and Unix machines.

Gopher systems can also be accessed by connecting to a remote client through a normal Telnet session from a standard terminal. Although Gopher provides a navigation route for the user, it does not offer very much 'signposting' to the location of particular items, and the more popular and extensive the gopher idea becomes, the more confusing the traversal of 'gopher space' is for the user, offering numerous different pathways. Veronica is a development of the gopher principle to a further stage by offering keyword searching of most gopher server menu titles in the entire gopher web. The results of a search are presented as a gopher menu, constructed especially for the search criteria, listing items which are direct pointers to a gopher data source.

The gopher idea has been extremely successful to date, offering a simple to construct and easy to use interface to network resources, which can incorporate a diverse range of information objects. As the scale of activities has grown, however, the method has become more difficult to use and there are doubts on the extent to which the current version can scale up to the level required for mature network access.

World Wide Web (WWW)

The World Wide Web (WWW) system was designed to support information sharing and computer support co-operative work among researchers and academics in the field of high energy physics; the work was largely done at the CERN Institute near Geneva. The concept has been taken up by researchers working in other areas, and is now achieving a wider applicability.

Whilst gopher has become popular through its ease of use and implementation, the World Wide Web concept is seen as offering a higher level of sophistication although it is more difficult to install and manage. A World Wide Web system consists of documents and links; the web contains many types of document, including searchable indexes and hypertext documents which contain embedded pointers to the contents of other items. The idea of the web is that a user may follow a link placed within a document by selecting that word with a mouse or cursor, and thus retrieving the document pointed to wherever it is located in the world.

In this way, the World Wide Web supports non-linear navigation through a universe of documents, which can be extended to include different kinds of information media. Essentially, this is analogous to the type of hypermedia package now commonly available in CD-ROM for personal computers, with the difference that the information is spread over a global network. When the software client displays a document taken from a World Wide Web server, a reader can either request a Boolean search by typing in keywords and commands, or follow a hypertext link from a highlighted phrase to another document.

The client will send a request to the server for either action; depending on circumstance this may be the same server or another World Wide Web server located in an entirely different place. From the user's point of view, the user interface remains the same wherever the information is located; while Boolean searching is based on text, links can point to any information object which can be displayed on the workstation, including graphics, image, and audio files. The proper functioning of the web depends on three interacting concepts which work as standardized protocols, and which web servers must be able to understand.

1) All information items have an addressing system which enables an individual document to be identified, so that each document has a title and a Unique Reference Locator (URL) which identifies the access pathway through which the file can be located and retrieved.
2) A Hypertext Transfer Protocol (HTTP) is used by World Wide Web servers to communicate with

software clients over a TCP/IP network, and includes a negotiation of formats which the client machine can deal with and the server is able to produce in order to agree acceptable information types that can be requested and delivered for the session.

3) A Hypertext Markup Language (HTML) based on the Standard Generalised Markup Language is used for the transmission of basic menus and online help from the server to the client, which must be able to translate this into on-screen presentations.

A web can access many existing data systems as well as hypertext-based documents. This enables World Wide Web servers to exchange information with the other widely used navigational tools such as WAIS and Gopher. There are a number of software clients, or browsers, available for different hardware platforms, ranging from simple terminals to X-Windows-based workstations and including Macintosh and MS-DOS/ Windows packages.

Developments in software industry

The booming software industry setting the pace of the information technology, revolution and the pace is frantic. Hardware is no longer where the action is. Computers are becoming remarkably similar in many cases they are turning into off-the-shelf commodity products. Now the computer wars are being fought on a new battleground: software—the instructions that tell computers how to do everything from processing payrolls to playing video games.

A key reason for the change in emphasis is an overwhelming demand from customers for packaged software that will let them apply computer power to a broad range of new tasks. Increasingly, corporations are-finding they do not have the resources to write the programs they need. As a result, most companies have stopped writing their own software and are instead buying standard software packages. The booming demand for new and better programs has quickly turned software into big business.

As recently as three years ago, software was stiff a cottage industry, with sales totaling just $2.7 billion annually. This year-according to estimates by Input, a California market research firm-sales are expected to top $10 billion. With the industry growing that fast, several once-small software companies have become sizable corporations. Management Science America Inc. (MSA), for example, the largest independent software supplier, quadrupled in size during the past three years, topping $145 million in sales in 1983. Trying to capture some of the soaring market, thousands of new companies have entered the software business in recent years; by one count there are more than 3000 software companies now. While over the long term a shakeout is probably inevitable, the near-term outlook for most of these companies appears extremely bright. Sales of software for personal computers—the fastest-growing part of the software industry—should rise by an astounding 44 percent annually over the same five years.

Nearly all software companies concentrated on a particular niche and fit neatly into one of three distinct market segments that were divided along the same lines for both mainframe and personal computers. Systems software, which handles basic housekeeping operations such as controlling the printer and memory, was supplied primarily by the computer makers. They were joined by independent software companies in providing utility software, which, among other things, helps programmers write programs. And a host of other independent software companies competed in the third market; applications packages, which tell a computer how to carry out specific tasks such as accounting payroll or word processing.

To provide a full complement of software for their computers, makers such as Hewlett-Packard, Burroughs, and Prime Computer are rushing to buy applications software companies. Other manufacturers, including Honey-well, Sperry, and Digital Equipment, are setting up joint ventures with software suppliers.

Software companies are expanding product lines to maintain their competitive edge. Those that supply programs mostly for large mainframes—MSA, Cullinet Software, and Computer Associates International, for example—are snapping up personal computer software houses. And companies that specialize in systems software for personal computers—among them, Ashton-Tate, Digital Research, and Microsoft—are adding general-purpose applications software to their product lines.

To grab a piece of the action, publishers and other communications companies outside the computer business-including CBS, Dow Jones, Dun & Bradstreet, McGraw-Hill, and Simon & Schuster-are licensing programs they then sell through their own distribution channels.

Japanese computer makers are launching major software development efforts. Perhaps the best evidence of just how important software has become is the drive by Japan's Ministry of International Trade & Industry to change the law to boost Japan's fledgling software industry. One result of many of these trends is that mergers and acquisitions in the industry are at an all-time high. Last year there were 146 acquisitions, valued at more than $1 billion-up 130 percent from 1982-reports Broadview Associates, a New Jersey company handling such transactions.

Software suppliers are struggling to formulate new strategies. One common focus is advanced design-especially the development of software aimed at making computers easier to use. But just as important to the success of new software as advanced design is marketing. Nowhere is the new attention to marketing more noticeable than in the hotly competitive personal computer business.

To reach the millions of personal computer users, software companies are spending huge amounts to introduce and advertise their products. Industry watchers have dubbed this obsession with splashy promotion "the Lotus syndrome-a reference to the more than $1 million that Lotus Development Corp. spent over a three-month period in 1983 to launch its first product, the highly successful 1-2-3 package.

Advertising has grown so important to software success that it has become one of the biggest barriers keeping out new companies. The cost of technology development is dwarfed by the marketing cost; the ante has really been upped. Even companies that write software for the large minicomputers and mainframes are plowing more money into marketing.

Software marketing now means beginning with detailed product planning, so that a program will better meet the needs of customers. Before Wyly Corp. even began a $20 million program to diversify into applications software, for example, it brought in all its salesmen from the field to tell programmers what customers wanted-something most software companies had never done.

As competition heightens and customers become more demanding, companies selling personal computer software are providing a level of customer support far greater than anything they offered even a year ago.

Establishing a marketing presence is especially critical to companies that provide personal computer software, because they must win space on already crowded retail shelves. Computer retailers are reluctant to take on new software without feeling confident it is a winner. Broadening a software line also helps a supplier leverage the large amounts of money spent on establishing a reputation and brand recognition.

Microsoft is plunging into such applications software as word processing and financial analysis to build on its reputation as a supplier of personal computer operating systems. The trend toward comprehensive offerings will force small companies to target well-defined market niches. There will continue to be demand for specialized packages designed for the needs of a particular industry or profession.

The most fundamental change in the software industry is the blurring distinctions among the suppliers. No longer can they be neatly divided into companies that make basic systems software and those that write programs for specific applications. Moreover, the top mainframe software companies are rushing to market with software for personal computers. And vendors serving only the personal computer market are joining with suppliers of mainframe software.

As the emphasis in the data processing industry shifts to software and, as software companies strengthen their sales, service, and distribution the big-system makers, too, are scrambling to do more to provide their customers with software. Most of the big-system companies, however, are turning to software specialists for help, since much of the demand is for applications software finely tuned to specific industries.

With most software companies trying hard to move in the same direction, everyone will face stiffer competition. Already, prices for personal computer software are sliding wherever similar programs have proliferated-in electronic spreadsheets and word processors, for example. And a big battle is under way among suppliers of the various "windowing" software packages-software "environments" that permit the users of personal computers to display several tasks at once.

One of the main reasons software has become so highly visible is that the computer has moved from the back room into the office. Programs of the past, buried inside corporate data Processing centres, primarily handled clerical and accounting tasks, such as turning out payrolls and keeping track of accounts receivable. Today's computer handles a rapidly increasing variety of management tasks—employing information as a competitive marketing weapon, for example. That trend, coupled with the explosion in the use of personal computers by executives, has given new prominence and importance to software in us corporations.

Individual owners of personal computers are no different from large corporations: over the life of a computer, its owner will spend $2 on software for every $1 spent on hardware, according to industry estimates. But users are finding it increasingly difficult to produce their own programs. Writing software is still a time-consuming process, and users find that, while they want to employ their computers to handle more applications they do not have enough programmers, time, or money to write all of the necessary software in-house. To come up with this software faster, computer users are compromising-buying more ready-to-run software packages than ever before.

The customer's new attitude toward software is beginning to alter fundamentally the way that computer systems are sold. Millions of nontechnical users are now running computers. These new operators, however, refuse even to read an instruction manual, let alone memorize the cryptic commands of the priesthood. Their aversion, coupled with the dramatic slide in the cost of computer power, has created a revolution in the way software is written. Today, making a program simple to control and easy to use is just as important as what the program actually does.

To reduce the number of commands that a user must memorize and type into a computer to get it to work, the latest software enables users to communicate with the machine in new ways. Some of these techniques are relatively simple, such as establishing menus to show users what commands are available to choose from. The most elaborate methods, used on such machines as Apple Computer Inc.'s new Macintosh, replace commands with an array of tiny icons or pictures-for example, a file folder to indicate filing. To tell the computer what to do, users point to the appropriate picture on the screen by moving a pointing device called a "mouse" over a desktop.

Early programs were built to accomplish tasks, such as calculating financial forecasts, with only the data located within the user's own computer. But users have grown more sophisticated and now want to get data stored in other machines.

This embryonic method of programming, which enables software to mimic human thought more closely, might one day be the easiest approach to use. It is starting to show up in programs such as Artificial Intelligence Corp.'s Intellect and Microrim Corp.'s CLIO, which let a user ask a computer for data with English sentences rather than esoteric commands.

Most programmers are ill-equipped to figure out how office workers and other nontechnical users best handle computers. So companies are bringing in professionals from disciplines as far afield as education and psychology to help in the design of man-to-machine communications. AT&T, for example, had a staff of psychologists survey about 400 computers users to help it decide how to add commands to its Unix operating system.

Designing easier-to-use software also requires new development techniques. For instance, International Business Machines Corp. now tests its new software in usability labs. In these labs, volunteers try to use IBM software while researchers with video cameras watch from behind one-way mirrors. A lot of discussion is going on in research circles over how best to use menus, pictograms, and other techniques to help both computer novices and experts. The type of coaching that a neophyte computer user requires becomes annoying once the user has learned to use the software. If a user types in a command less than two seconds after being asked for it, the program assumes the user is proficient and skips over the menu listing of options. Users who take longer are given the benefit of directions from a menu. Researchers are also struggling with the problem of how to standardize commands. Each computer program now uses different commands to accomplish the same function. An early attempt to solve this problem is the "environment" or "windowing" software packages for personal computers that are now coming to market.

These packages-products such as Microsoft Corp's Windows and VisiCorp's Visi On-divide the computer screen into segments, each of which shows a different task. Common functions are performed the same way in each window. The large amount of this kind of innovative software now being developed to make personal computers easier to use is also forcing the mainframe software companies to follow suit.

Another software challenge is to find simpler ways to exchange data between programs. In most cases, swapping data between a large mainframe and a personal computer is difficult because the two units use different formats for storing their data and different commands for retrieving them. Software vendors are not waiting until everyone in the industry agrees on what common language all computers should learn. Some experts think the ultimate mechanism for exchanging data is the use of sophisticated file-management software, often called data base management systems.

Artificial Intelligence (AI) software may soon make computers even easier to use. Some companies are already working on AI programs that will eventually be able to remember an individual's habits in using the computer. The first AI applications from Microsoft-expected within the next year-will be likely to use these rudimentary pattern-recognition techniques in tutorial programs that teach novices how to operate software. These programs will adjust the level of tutorial difficulty by determining the proficiency of the student running the program. The computer manufacturers' efforts to develop all the software themselves have been crimped by the large sums they must invest to improve methods of getting information into the computer and processing it. But it would be dangerous to write off the Japanese as competitors in world-class software.

Information society

The term information society has only been used for about a decade, superseding the less specific label service society, and the even more ambiguous post-industrial society. Forerunners to information society include the terms age of cybernation, electronic age, and age of information; knowledge society, and the ungainly technocratic society. Why should information society necessarily last to 2000? A new variant might come into usage, such as telematic society, or even the age of infoglut, which focuses on the pervasive condition of information overload.

Unemployment caused by the automation of office work and other informational services may be extensive and, if not compensated by an equal number of new jobs in the information sector, could result in a labour force no longer dominated by information-related occupations. The major activity of society would then be some other occupation, or even involuntary idleness—the lack of any occupation. It should also be acknowledged that there are other concurrent technological revolutions that could have an even greater impact on society than the new information technologies.

In the wake of such a grim scenario, information society would seem in retrospect to be the ultimate illusion of modern man. Although the nuclear threat is growing, most experts still think it unlikely that we will experience a nuclear Armageddon. Nevertheless, there is an increasing possibility of serious disruption by war or terrorism. If we survive, it is likely that we will have an information society of some sort, although we might not call it that. An intelligent approach to assessing the future would acknowledge the potential for changing images.

A revolution in communications is widely assumed. The phrase revolution has been used promiscuously in recent years, even among those whose scientific training would seemingly inhibit rash statements about technical and social developments. Remarkable developments have occurred in the cluster of technologies comprising the communications revolution. These include not only the notable reductions in computer size and cost, combined with dramatically enhanced capability, but also the expanded use of satellies, cable television, home information services, and the many applications of microchips. Developments in technology can to some degree be anticipated, especially by procedures of collective thinking such as the Delphi method, which assembles expert forecasts, refining and revising them with two or more rounds of questioning. The potential impacts of individual technologies can be assessed. The French government has sponsored a study of the impacts of computerization on society, and the Science Council of Canada has expressed concern about planning for an information society.

In the midst of an inchoate revolution in communications technology, this relatively simple act of communication between researchers and responsible policy-makers has not occurred. A cautious approach to the communications revolution would be to withold such a label for the present. In contrast to the changes wrought by other technological revolutions in the past 200 years—railroads, the telegraph, telephones, electric power, automobiles, radio, and television-the new cluster of communications technologies has yet to shape the lives of most people profoundly.

Still, these new technologies are likely to be immensely influential in the next few decades, if nuclear weapons have not obliterated much or all of humanity, and if a worldwide economic collapse is avoided. The development and dissemination of new technologies will probably not be as rapid or as widespread as many enthusiasts today believe. But the revolution will proceed, for there is little or no public opposition, and governments at best have only been able to influence.

It is important to recognize that, while error-free communication is an ideal, non-communication in modern society appears to be widespread. Examples include failed communications, flawed communications, miscommunication, and junk communication The new communication technologies will greatly multiply capacities for storage, transmission, and manipulation of information.

Major changes in the workplace are likely, with many jobs eliminated and new jobs created. Robots in factories will presumably perform many tasks that are dangerous or boring. Automation of office work will displace a large part of the female labour force, but, presumably, will also enable better communication within and among organizations, and allow some degree of decentralization of workplaces to rural areas and individual homes. Relationships between buyers and sellers may be improved with the advent of teleshopping, which would give consumers better information on alternative products. Credit cards activated by thumbprints should be a further advance toward a cashless society. Computerized communications already offer physicians better access to medical knowledge, and the computerization of personal medical histories can supply valuable patient information.

Individuals will also have much better access to medical information for their own self-care, with new devices to monitor body processes, worn on the wrist or implanted in the body. Microprocessor implants, for example, could detect the first sign of malignant cells being generated. New developments in microelectronics promise at least some degree of hearing for the deaf and sight for the blind, and computers might even act as psychotherapists. Many people will surely have more electronic options for their pleasure, including videogames and simulated experiences, 100-channel cable television, cheap collector dishes enabling access to increasingly sophisticated communication satellites, and various videodisk and videocassette recordings. Some or all of these will be accompanied by greatly improved presentation in the home, such as wall-size television displays, improved high-definition pictures, and stereo sound. It remains to be seen, however, whether this will result in an abundance of high-quality options or merely a multiplication of banality, a vibrant free market between entertainers and audiences or cultural monopoly and control by governments and information conglomerates.

The potential for electronic access to the world's knowledge and for computer programs of instruction, multiple cable television channels devoted to education, instructional videotapes and more, offer enticing possibilities for an education revolution, both within and outside of schools and colleges, that would affect the learning of both children and adults. But the general caveat for all aspects of the communication revolution-not as much, nor as soon-is especially applicable to education. Educational institutions serve many functions other than learning, and they are difficult to change. Extensive self-directed adult learning is possible, but serious utilization of information abundance must compete with the many enticements of non-serious entertainment. Indeed, the mind-deadening influence of television is a major explanation for the steady decline in test scores among American high school students over the past 20 years. Sober analysis of who is learning what as a result of the new technologies will be required.

Information technology will further widen existing divisions between the rich and poor, and create a new generation gap between the computer-literate young and their print-literate elders. Equal caution should be applied to predictions of enhancements in political communications. The new communications technologies offer many promising ways to make societies more democratic: e.g., electronic plebiscites and opinion polls, teleconferencing with representatives, cable television channels devoted to legislative proceedings, and better voter information on candidates. But these possibilities will not necessarily be realized, and could be more than offset by a dossier society utilizing a centralized data bank, improved surveillance capabilities, new lie detector technology, and narrow-casting of political messages enabling candidates to say different things to different groups of voters.

The new abundance of information, and its further fragmentation to meet the needs and interests of myriad racial, ethnic, religious, intellectual, political, commercial, and leisure interests, is unlikely to facilitate intergroup harmony and sharing. Mass broadcasting lacked diversity and generally aimed at the lowest common denominator; but it did at least provide a shared experience. The de-massification of the media-enhances the virtue of greater variety, but the dark side of this trend is a chaos of specialized interests. And to the degree that one finds ample entertainment and education in the home, people will spend more time in their living rooms, and less time with their neighbours or in public places. Relations between men and women, husbands and wives, and parents and children may be enhanced by the imminent spread of mobile telephones and the possible development of two-way wrist video devices. But the multitude of specialized entertainments may nevertheless serve to strain these intimate relations. Another important factor affecting communications within families will be the amount of leisure time available, which may or may not be improved by productivity increases at work and decentralization of workplaces.

The new communications technologies will produce overall improvements in work, commerce, health, and entertainment. These technologies also offer considerable potential for improving education and politics, but we should be very cautious in making forecasts and assessments. Communications between groups and within families could improve, but are perhaps more likely to worsen. In all these areas, considerable monitoring will be required to provide a reasonably comprehensive answer to the question of whether we are communicating better.

Will the new information technologies lead to improvements in the quality of life? One must immediately ask, improvements for whom? There will surely be winners and losers, within and among nations. Economic abundance may result from the information revolution; Paul Hawken, for example, postulates that we are in the midst of a tumultuous transition from the mass economy of the industrial age to the informative economy, where information increasingly replaces mass as a factor in production, resulting in better goods and services. But this does not necessarily lead to more equal sharing, or to enhancement of the median benefit.

The promise of information technology is that they will be labour-saving, allowing more people to have more leisure. But what is to be done with those who have involuntary leisure forced upon them? And among the employed, voluntary leisure in a technological age can prove illusory. Many professionals today find their workloads increasing, rather than decreasing. New ways to process information may only add to the chaos, much as superhighways have inadvertently led to more traffic congestion. Besides economic indicators of quality of life, one must also assess political and human indicators.

Will information technologies increase or decrease the threat of nuclear war? Can we maintain and expand democratic forms of governance? Will non-democratic governments be strengthened by the new technologies? Will we spend more time in pleasant and productive interaction with people, or will our interaction with machines increase to the point where computers become our most important teachers and our best friends?

Every society requires a minimum standard of competence for its members. The information society will demand a new standard of literacy, well beyond merely knowing how to use a computer. To survive in any civilized fashion, we must learn to cope with what Alvin Toffler refers to as our "blip culture" of immense diversity, contradictory fragmented images, and shattered consensus. The new literacy will require the ability to distinguish between knowledge and mere information, and to seek out wisdom amid abundant knowledge. Lifelong learning has been extolled for many years, but the new economic literacy will require an ability to learn, and a willingness to retrain for new occupations. Finally, the new civic literacy must include an understanding of global affairs, for the new technologies of communications, combined with such problems as pollution, access to ocean resources, monetary chaos, and the arms race, are accelerating the process of globalization. But, in contrast to these needs, what do we in fact know?

Technological man does not yet exist, and neoprimitive man continues to be trapped in a technological environment, in which things—not human beings—are in control. In introducing his notion of "meaning lag," Canadian sociologist Omin Klapp warns that meaning formation is slow and inefficient, compared with the speed and amount of information now accumulating in society. We live in an age of ignorance, where the learning needs of all age groups are outracing their attainments. Our nation is indeed at risk. However, the most important learning needs are not among children, but among adults—especially our political, intellectual, scientific, corporate, and religious leaders-the decision-makers who will be shaping the information society over the next two decades. Their decisions, for better or worse, will largely determine whether the information society is humane, just, productive, free, participatory, and safe, or whether it is a society characterized by greater inequalities, more centralization, accelerating dangers, and further alienation. Such a reorientation of educational priorities is unlikely, though-at least during the next few years.

We still fail to recognize our widespread ignorance and the need to focus on adult learning because the academic degrees that many of us hold convince us that we are well educated as individuals and as societies. We wish to appear knowledgeable and sophisticated, and this image is reinforced by the sophisticated technologies at our individual and collective command-tools such as computers and automobiles that many are able to use, although comparatively few really understand them very well. The citizens of the industrialized countries live in a society that is developed in manufacturing era terms—but overdeveloped when assessed by humane and ecological measures, and underdeveloped as an information society.

Our society is underdeveloped because of the gap between our present abilities and our need to learn new skills and shape new worldviews. This ignorance gap appears to be growing. The fragmentation of perspectives increasingly found in the wider society is reflected in the subject of communications itself, which is studied by the professions of journalism, education, and information science, and such cross-disciplinary areas as computer science, management science, behavioural science, language and area studies, and future studies. Adding to this intellectual tumult, researchers in the social sciences often specialize in the economics, politics, and sociology of information and communications.

Economic development

The introduction of railways, of electric power, of the internal combustion engine, or of the computer are all examples of major economic and social transformations involving entirely new industries, new types of capital goods, components, materials, new skills at all levels, new management attitudes and systems, new education and training systems, new occupational and industrial classifications, new design and, development systems, new legislation, and new forms of finance, company organization, and ownership.

The widespread generalization of the new technological paradigms is possible only after social institutions have adapted to the requirements of the new technology. During the 1970s and 1980s labour productivity growth has slowed down markedly. Yet almost every engineer and scientist would agree that the technological potential for productivity increases has never been greater. Labour productivity has continued to increase very rapidly in the electronics industry itself, and the potential applications of microelectronic technology are innumerable, extending to every branch of manufacturing and the services. Productivity slowdown therefore can in no way be explained by the slowdown of technology, but must on the contrary be explained by some degree of incompatibility or "mis-match" between the new technological paradigm and the institutional or social framework.

New technological changes affects every branch of the economy, in terms of both its present and future employment and skill requirements, and its future market prospects. It has resulted in a drastic fall in costs, as well as vastly improved technical performance both within the electronic industry and outside it. By contrast, the newer biotechnologies, although they certainly also have enormous future potential, have not yet reached the point where their macroeconomic impact could be great enough to carry the entire economy forward in the next decade or two. There are of course innumerable other types of technical change that affect particular processes and products, many of them important for individual industries.

In most sectors of the economy we see the relationship between physical capital and employment as "clay" rather than "putty." From the evidence of past long waves of development, we assumed that there will be some tendency for the employment-generating effects of new technologies to be strongest in the early period of growth. At this stage there is little standardization of components or subsystems, and a specialized industry supplying capital goods has not yet developed. However, as growth accelerates, economies of scale, specialization, and standardization lead to a more capital-intensive pattern.

In the past experience of long waves, such tendencies in mature industries and sectors have been overcome on the one hand by structural change—i.e. a shift in the pattern of demand toward more labour-intensive sectors, with lower-than-average investment needs per unit of output—and on the other hand by major technical changes in various sectors of the economy, which brought about a rise in capital productivity, reversing the previous trend of the downswing of the long wave.

Each of the major new technological paradigms has involved a drastic reduction in costs, so that it became managerial and engineering "common sense" to take advantage of the new technology in product and process design and in relation to all types of business decision-making. This occurred with respect to the fall in transport costs and in steel costs during the nineteenth century, and the fall in energy costs in the twentieth century. It is happening now with information technology and microelectronics. It is essential, however, not to underestimate the vast scope of institutional change that is needed. It will involve enormous changes in the pattern of skills of the workforce and therefore in the education and training systems; in management and labour attitudes, in the pattern of industrial relations and worker participation; in working arrangements; in the pattern of consumer demand; in the conceptual framework of economists, accountants, and governments, and in social, political and legislative priorities.

Perhaps the most important point is that "intangible" capital investment must now be recognized in its own right as more important than the transitory physical capital investment, which is today the main focus of attention for most managements, accountants, and economists. For a long time firms in the computer industry have devoted more resources to R&D, education and training, information services, design, and software development, than to physical capital investment. This balance will now be tilted even more toward intangible investment as the information systems available to firms, government departments, and other institutions are becoming their most critical resource. This applies both to formal information systems and data banks and to the costs of developing, educating, and training the people involved.

Even in a period of high unemployment, there arc still persistent skill shortages for certain types of labour, particularly in relation to electronic engineering, software design, and systems analysis. In addition, there are many types of skilled people whose level of training and qualification is inadequate for the new types of work that they are being called upon to perform, or ought to be able to perform. The information revolution also affects the whole climate and conduct of industrial relations. It makes possible the most sophisticated centralized type of "Big Brother" time and motion study, whether of sales workers in a supermarket or of miners operating an underground shearer-loader. But it also make possible a very high degree of decentralization, local responsibility, and initiative.

Computerization will also facilitate the introduction of much greater flexibility in working hours. In many occupations flexi-time has already been introduced, and the scope for this will be increased. Part-time work and work-sharing are likely to become more widespread. But here again, this social change can take a variety of different forms. It could be introduced as a means of depressing wage levels and of reducing social insurance benefits, if part-time workers are treated as a lower-grade type of labour. Or it could be introduced mainly as a response to the desire of many workers—male as well as female—at various stages in their working lives to work part-time, so that they can spend more time with young children, on pursuing education and training, or on other activities.

Strategic control of IT

The changes taking place on the technical side of the information technology fence are nowadays almost as dramatic as the changes made when the computer was first introduced. At the same time the business and commercial world is beginning to take up the challenge of information technologies in ways which have not been seen before ways which do not represent technological miracles but business revolutions. Industry boundaries are being eroded by competitors who have an information edge.

Although information technologies are now intruding into the activities of most business managers it is not generally true that the computer is a welcome intrusion. Nor is it true to say that the computer has often improved the actual efficiency or performance of the manager. Nowadays it is relatively easy for a manager to surround himself with computer-generated information. Sometimes the manager becomes fascinated by the new tool and excessively interested in manipulating information at the expense of other aspects of his job. More often the result is that the information goes unused and the management process is largely unchanged. Certainly there is little evidence to suggest that the information opens up new management opportunities. Few managers would argue with the need for accurate, timely, relevant information. It is perhaps a truism to say that the best informed manager has the best chance of making the best decision.

Many managers would find it difficult to define their information needs in relation to their decision making process. They would find it even more difficult to relate these to the opportunities offered by information technologies. The most common management view of information technologies is perhaps that they offer vehicles where by their staff can produce information more quickly and more accurately—but in practice the technologies cause restrictions and problems.

IT has certainly progressed at a revolutionary pace, constrained partly by the inability of the software specialists to keep pace and control costs, but constrained mainly by the adaptiveness of the people who run the business. Most innovations of a scientific nature have taken many years to achieve their full potential. We are probably only half way through the computer revolution and the second half will certainly be driven by the skill and imagination of those who can profit from the technology rather than by the technical advances of the engineers.

Certainly the technologies will continue to change and the rate of change may even quicken but the ability of managers to live with that change and make it work for them will be the critical success factor. The economic signs are that information is going to be a crucial factor in business growth. This already evident in many areas of the economy especially in the financial services sector. The spread of information power is likely to cover many more sectors of the economy as people grasp the implications. If you do not see this now but wait for the next technological miracle to raise its head then your competitors will steal an advantage over you. The need today is to take a realistic view of your company and the exploitation of information. You need the tools to be able to assess your performance and to identify the priorities.

Success in the application of technology can only be measured in terms of the success the organisation has in utilizing that technology. A strategy for technology, therefore, can only be derived on the basis of an agreed strategy for information and its management. The success of an information strategy will be measured in terms of the ability of the organization to capitalise on the opportunities, either by operating more efficiently and more effectively, or by deriving some competitive or business advantage from the technologies. Managers will be able to support their decision making by having accurate, relevant and timely information available to them. In addition, since it is recognised that technologies are changing rapidly and new opportunities have to be seized quickly it is essential that the business has an organisation and culture which is adaptive and able to respond to these challenges.

The most significant prerequisite to derivation of this type of strategy is that management recognise the scope of the subject and begin to think in terms of the technology. A major obstacle in this process of awareness is that many information strategies today are conceived, described and classified in terms of the technology itself, e.g. computers, communications and software. They need instead to be described in terms of the management processes which they are intended to serve. Rather than just learning how to use databases, word processing, electronic mail etc., managers need to know what technology is available for getting work out effectively, handling various kinds of information, communicating, making decisions or planning.

An information strategy which is driven by the technological opportunities is typically the type of strategy which produces systems which are operationally effective but ineffective in terms of achievement of business benefit. Typical results are computer terminals with advanced capabilities sitting in an undisciplined and unprepared production environment, reports lying unused on the desks of unreceptive users, people who regard IT as a threat and sales forecasts and schedules which lack credibility because the information is inaccurate or unrealistic. For a quarter of a century we have been trying to put computers to work successfully.

Certainly we have learned a lot about the conflict between technological revolution and business system evolution. It is questionable, however, whether the experiences of implementing major mainframe projects, involving large teams of specialists and taking months or years to realise, can be directly applied to the problems we face today. We are dealing with a different technology, a different scale of investment, and much of the past, we are in danger of tackling the wrong problems, of taking a conservative and cautious investment approach, and of missing the main objectives which are seeking to achieve. Information power requires the right blend of technologies, information structures, business systems and people skills. The key to success is to recognise that all these aspects need to be assessed and balanced to constitute a receptive environment and to capitalise on the opportunities.

The work technology encompasses all of the technical aspects which impact information processing. Nowadays this means the combination of computers, communication devices and the software which drives them. There is also a need for adequate technical support in terms of provision of guidance in the selection and implementation of the equipment and the back-up needed to maintain operational performance. An essential task of the technology specialists must be to maintain a watchful eye on the changing markets and to assess the opportunities as they arise.

Perhaps the most obvious sign of a successful technological operation is that the IT department has come to be regarded as a consultancy service to the company offering information and advisory support to the management. The other side of the coin—the bad news—is where the IT department has either become an ivory tower handling all the complexities of major operational systems and usually having to be accountable for the success or otherwise of their ventures, or a much reduced operation which has divested itself of the role of systems analysis and project management and offers a technical computing service to anyone who requests it. If line managers can grasp the totality of information processing and accept accountability for the end products they will also recognise the need for the support of information specialists in achieving their goals.

IT specialists will be asked to do that which they are capable of doing but not be given the mission impossible of trying to enlist the support and commitment of an unreceptive user community. This may require a move from the traditional specialist roles as Doers and

Prescribers towards those of trainers, advisers, educators or counsellors. IT specialists will also have to provide independent advice on purchase and use of both hardware and software, as well as continuing to help with installation, some aspects of system design and user support. They also need to establish suitable electronic communications and information structures to provide the skeletons onto which users can put the flesh.

Although the need for accurate and relevant information has always been recognised, the realization of the ideal has been severely restricted by the pure limitations of volumes, communications and accessibility. Technology now offers dramatic opportunities in that these restrictions have largely been removed. Unfortunately realisation is providing rather more difficult than might have been anticipated. The release of these limitations has in many cases only served to reveal a new set of limitations.

An information environment has to be created which provides an information structure which is commonly agreed and supports individual applications. The information has to be comprehensive in that as much information as possible is available to contribute to decision making. There need to be mechanisms for controlling the integrity of information and people have to be information aware.

In assessing the performance of your information structure at present you should be looking for high levels of data accuracy and an acceptance by the users that the computer information is reliable, proven and relevant. The opposite effect is that alternative sources of information spring up and begin to assume equal importance. Regular reruns to clear data discrepancies, continual reconciliation failures and lengthening error reports are all symptoms that the information environment is on the sick list. Information awareness among the people who uses the system means that they not only maintain the accuracy of their computer data but that they also refuse to allow inaccuracies to multiply. Typical cases of information anarchy are the stores controller who may be told there is a shortage but knows very well that there are some parts available which the computer does not appear to have registered.

By their nature computer systems are rigid and disciplined. There is a long way to go in the development of expert systems before the computer can be as adaptive as it would need to be in some of the chaotic environments which can be seen in some businesses. Assessment of your strengths and weaknesses in this area, therefore, can prevent trying to achieve the impossible task of imposing a discipline and a culture by means of the technology.

A business system is a mixture of formality and informality, normal practice and exception, people, paper and machine. In some companies there is a great deal of formalisation and stability whereas in others change and innovation is the order of the day. This is not to say that systems which are subject to changes are not suitable for computerization—on the contrary there is usually increased benefit in this environment if IT is used successfully.

What it means is that the technology has to be applied quickly and great effort has to be put into guiding the company into a different level of integrity. In more stable environments the very stability is likely to prove an obstacle since the new systems will challenge the status quo and innovation is not seen as necessary. The management challenge is to make an objective judgment of the systems environment in which they work and to identify those aspects which need to be nurtured through the ascent to information power.

Since we have recognised that we depend on skilled people with the right attitudes to make the systems work, to maintain the information integrity, and to be opportunity-seeking in their jobs, we must recognise that this raises new challenges in motivation, training, management and working relationships. The issues in motivation and attitudes can be summarised as:

— some people are afraid of computers, do not want to touch keyboards, think they are too old to learn and will avoid the technology.

— others are over-enthusiastic and spend too much time experimenting with new systems to the detriment of their job objectives.

— people need to develop a sense of ownership of systems they are using.

— people need to overcome blocks to thinking about new uses of IT which go beyond the previous manual systems.

The challenge to recognise these points and prepare the user community for the changes ahead. Education and training will be needed not simply in the application software to be used but in a wider context. In the area of working relationships, managing staff who are users of technology creates a new set of questions and requirements with which most managers are unfamiliar. How can you ensure, for instance, that your staff use the available technology neither too little nor too much for effective performance and that their performance becomes more visible when using common systems. Managers are at risk of interfering at a lower level.

A lot of publicity has been given to the needs for computer literacy. If this is interpreted as the need to appreciate computers or to use a keyboard with confidence then the training is wide of the mark. Again we are suffering from a nomenclature problem. If the people can become information aware then computer awareness will follow. Keyboard errors and mistakes caused by misunderstood applications can be corrected. Incorrect attitudes and inbuilt resistance to the changes causes wasted years, lost investment, and spoilt opportunities.

Just as an IT strategy can only be created in relation to an overall information strategy so the information strategy has to relate to other company strategies and planning cycles. Since these vary widely from one company to another it is not practical to present an information strategy technique. The most we can do is identify the relationship with other strategies, the general requirements for deriving and working to an information strategy, and the potential sequence of events in its derivation. The preliminary requirement for deriving an information strategy is that management accept the role and value of information systems and agree on a common information view of how the business is structured.

The manager who is concerned to initiate new thinking in information strategies is not going to be personally concerned in the understanding of these techniques. It should be sufficient to say that the techniques are available and your management team can apply them. Unfortunately this is not strictly true. The techniques available have not been created with management analysis in mind and there is no one commonly accepted method.

Several methods for the construction of an information picture of organisations have been developed in recent years. The early attempts, based on clerical and document flow-charting, have several major disadvantages which make them unsuitable as management tools. In particular they are all drawn at a single detailed level which makes them voluminous and confusing, they are a reflection of the present physical environment and they do not help to bridge the gap between the old and the new. The introduction of data base concepts has brought with it techniques for documenting and analysing data structures and relationships. These are rigorous, relevant and often revealing. They are again quite complex, however, and will not appeal immediately to a manager who is trying to come to grips with the information flows in his area.

What is required is an analysis of the information flows throughout the organisation showing the use of this information for operational needs, performance and control requirements and management decision making. These are usually linked in that most information used for control or decision making is derived and summarised from operational information. Nevertheless the distinction needs to be made if managers are going to be able to use the output in a constructive analysis and placing priorities on their information needs. It is clearly impossible to conduct a full and thorough information analysis of the entire organisation before embarking on the business of deriving a strategy.

Those organisations which have an IT strategy have usually developed it on the basis of immediate need and short term priorities, bearing in mind the in-place technology. Although this perhaps the obvious method and the approach taken in most planning exercises it may not be the best for information strategies.

Since we have recognised the increasing rate of change and the need to seize opportunities as and when they arise, an alternative approach which could yield additional benefits is to begin by painting a theoretical picture of the ways in which information could be exploited. Start with a vision of information power and withdraw to a practical reality.

Creating an information strategy is beginning to look like a rather formidable task. There has been speculation in some informed quarters that the information technologies could present the next source of power over the coming years. The financial director has had his day, the marketing men have reigned supreme, now the technologist will rise to power on the back of the increasing potential for exploiting information in business. If so, then the champion of the information strategy is clearly identified. This is not the case, however, in most companies. Very few have an IT director. The data processing manager is not usually in a position to perform such a role and it could be argued that he or she does not have the skills or track record to perform the task. The finance director is perhaps the one most closely associated with information systems and therefore the one best poised to assume the role. The strategy needs, however, to encompass a much wider field that the financial interpretation so often given by the accountants. So the motivation, awareness and skills of the management accountant have to be updated before the information crown can rest comfortably on his or her head. In the end it may have to rest with the chief executive officer to initiate the programme and control its execution. If so, then he or she will certainly need the support and commitment of the board and will probably need an advisory management body to keep the programme under control.

All organisations are different and the organisation of information has to reflect all the in-place organisational complexities. In assessing the options the final and most relevant advice would be to remember that the overall objective is to create a mechanism whereby a comprehensive system strategy can be established which is driven by the business needs and controlled by the management who have to live with the results.

The essential challenge of managing technological change is balancing the revolutionary effects of new technologies with the evolutionary processes of business changes and the even slower processes of change in the attitudes and practices of the people who make the business tick. The ultimate target is information power but the planning horizon for individual projects may have to be short if any degree of certainty is to be maintained. Managing change with respect to the computer projects of the 1970s was essentially a long term investment involving complex risk assessment.

Many of the technological risks have now been reduced through the availability of cheap hardware and instant software. This makes it technologically feasible to implement in weeks solutions which previously would have taken months. Unfortunately the associated changes related to the business, the environment and the human factors, are no less complex and the very speed of the changes serves only to increase the problems which can occur. The management of change is therefore as much a man-management exercise as it is a task-orientated project management exercise.

Manufacturing companies which have implemented modern material control systems have had to recognise this challenge or have suffered as a consequence. It has been known for companies to instigate major stock clean up exercises before conversion to a new system. In one case the introduction of a new product was rescheduled to fit in with a new material system. Had this not been done the changes in the purchasing department would have been too dramatic and the workload would have been unacceptable. Far from benefiting from the new system disciplines, the new product would have been jeopardised by its introduction.

Some projects may be driven by specific business needs and may fit comfortably under the management of a functional manager—e.g. a personnel records system has a clearly designated at the outset—e.g. integrated material systems usually impact many line functions. Others may be driven by a technological innovation where the departmental boundaries may not represent a problem but everyone is involved. For each project a suitable management structure is needed which will ensure the right level of commitment, adequate monitoring facilities, and a means of recognising and managing the inherent risks involved.

Information is management information only to the extent which the manager heeds or wants it; and it is significant only in terms of its relation to the accumulation of relevant knowledge and plans and to his or her personal responsibility. Establishing the information manager's need has never been easy. The problem of knowing exactly what data to collect and which to tabulate is not new.

It is possible for the management to collect more information than it can use to advantage, or which is more costly or hinders production more, than the information is worth. This is a real danger that has to be guarded against continuously, for routine that serves a valuable purpose when initiated may cease to be useful by some later changes in conditions.

After massive investment in computer based systems, management are served by even more rigid and unresponsive systems than in Elbourne's days. Traditional accounting systems have not helped. Information is far too often seen as the spin-off from some necessary accounting or administrative system.

Much information is produced too late to be effective or is not directly relevant to the manager's decision making needs. The technology has so far not solved the problem. There is a frighteningly common desire today to prove that incredible amounts of information can be developed with electronic devices by preparing business reports that are increasingly long, incredibly dull and, all in all, just plain incredible. Management's real information needs have not been clearly identified by those seeking to build information systems. There has been no real understanding of the way information is used by managers. The research that has been carried out has concerned itself with the more academic mathematical techniques than with aiding the managers' choice of alternatives. The fundamental basis for the design of a manager's information systems is a clear identification of management's information needs.

Information systems in the widest sense deal with all the ways in which information flows to the decision maker. Many of these flows can be considered informal where there is no planned structure for collecting, processing and storing the information. These informal system are often developed over the years and can be extremely effective. Many managers rely very heavily on these informal systems which have served them well in the past. It is not surprising therefore that they resist the move to more formalised methods, especially if these interfere with the informal systems. The idea that all information flows can be formalised and built into a comprehensive data base is preposterous. Such an idea can only stem from someone who does not understand the decision making habits of management. The answer lies in the design of information systems that complement the informal systems and that directly feed managers with the information they need to take the decisions their jobs require.

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